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GASTRODUODENAL ULCERS AND AUTONOMIC IMBALANCE *

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PART I. CLINICAL METHODS OF STUDYING THE AUTONOMIC NERVOUS SYSTEM

This work was undertaken in order to determine a method of studying the status of the autonomic system. An adequate, satisfactory method is not at hand. There are, however, rough qualitative observations that indicate that there is, in a high percentage of controls, a range of response in tissues supplied by the autonomic nervous system that can be accepted as a standard. In addition, it is evident from these experiments that under certain standard conditions a high percentage of so-called normal persons react in a characteristic manner to injections of epinephrine hydrochloride.

Keeping in mind the shortcomings of our method, we first studied a series of controls to formulate a concept of the normal limits of

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autonomic response. These observations then were compared with those found in patients suffering from various forms of gastroduodenal syndromes. These observations and inferences are presented in part II of this paper.

To avoid the confusion so frequently found in the literature of the vegetative system, the terms used here will be defined. "Autonomic" is used to include the entire vegetative system, as described by Langley,[1] Brown and others. The autonomic system is considered as having three subsystems—the tectal, bulbosacral and thoracolumbar (Langley). "Vagus" and "parasympathetic" are considered as parts of the bulbosacral division and "splanchnic" or "sympathetic" as equivalents for the thoracolumbar division. The word "neurosis" is used here to signify a general dysfunction rather than merely a disturbed mental state. "Gastric neurosis" is employed throughout the paper rather than "gastric dysfunction," because it conveys a general syndrome to the cylinical mind. "Dysfunction" may center the thought on the stomach alone.

INVESTIGATIONS OF THE AUTONOMIC SYSTEM

The autonomic system has been studied by three different methods—direct, semidirect and indirect.

By means of the direct method, results are attained through stimulation of a nerve ganglion, section of a nerve, or section of a nerve or extirpation of a ganglion with stimulation of the central or peripheral ends. Through the semidirect (pharmacodynamic) method, results are obtained with drugs that either paralyze or stimulate a nerve or ganglion; that is, by stimulation of the sympathetic nerves or ganglia, stimulation of the vagus, paralysis of the vagus, or stimulation or paralysis of nerve endings, myoneural junctions, etc. With the indirect method, results are obtained by studying objective and subjective alterations after a given experimental procedure. These are then compared with the results obtained in animals under experimental conditions of either of the foregoing methods. The common alterations that can be studied readily are metabolism, blood chemical and histologic alterations, cardiovascular reactions and endocrine alterations.

At best, all of these methods at present are incomplete and unsatisfactory. Even conclusions drawn from the direct method, which is probably the most accurate, are not absolutely sound. The defects in the knowledge of the anatomy and physiology of a given autonomic activity are many. The semidirect method is not entirely accurate because of frequent individual variations in the reaction to drugs and because the same drugs used in varying amounts and under different circumstances frequently produce different results. Anatomic and physiologic ignorance also invalidates conclusions in investigations by semi-

1. Langley: The Autonomic Nervous System, Cambridge, W. Heffer & Sons, 1921.

direct methods. The indirect method is, of course, the poorest of all. It is essentially argument by analogy with its consequent logical shortcomings.

Animal experimentation has been done chiefly by the direct or semidirect methods. Clinical experimentation is practically impossible by the direct method and, with a few notable exceptions, has been of the indirect sort. The semidirect method, however, is possible clinically and is probably as fruitful a source of information as any now available.

SEMIDIRECT STUDIES OF AUTONOMIC SYSTEM

For the purpose of pharmacologic experimentation by this method, epinephrine hydrochloride, atropine and pilocarpine are typical of the drugs used. The generalized reactions produced by these and similar drugs known to act on the autonomic system are in keeping with the anatomic evidence of nerve supply, with the exception of the skin—a discrepancy that will be discussed later.

Epinephrine.—This drug acts on the myoneural junctions in all organs innervated by sympathetic nerve and produces a generalized reaction. In their original observations on the effect of the injection of epinephrine hydrochloride, Oliver and Schaefer mentioned only pressor effects. These were more marked when the vagi were cut and after atropine was given.

During the next few years the effect of the minimal, optimal and maximal doses was determined. The greatest vasoconstriction was noted to be chiefly in the arterioles; the larger vessels actually dilated. Although the vasoconstrictor center was indirectly affected through anemia from contraction of the arterioles, no direct central action was noted. Some slight vasodilatation was seen after the sympathetic ganglion was painted with epinephrine. In 1900 it was observed by Moore and Purinton that small doses of epinephrine, instead of producing a slight rise or no rise, actually produced a fall in blood pressure. (Doses of from 0.005 to 0.01 mg. per kilogram produced a rise in blood pressure from 0.006 to 0.003 mg. produced a fall.) This was not universal. It was observed that the original tonus of the vascular system was a factor determining the actions of epinephrine. If the tonus were low, the result was a depressor effect; if high, a pressor effect. For example, after pithing, with its associated drop in blood pressure, there was a further drop in blood pressure after small doses of epinephrine. Depression also was noted after splanchnic section (Hartman). Small doses actually cause dilation in a normal limb and constriction in a denervated limb. Large doses cause constriction in both. The dilator mechanism probably lies outside the central nervous system. The site is apparently the ganglia, because typical results are abolished after a ganglion is painted with nicotine.

To summarize, epinephrine may be either a vasodilator or vasoconstrictor, depending on the dose, the organ involved, the constitutional condition of the organism (tonus of vessels, etc.) and the endocrine state.

Atropine.—This drug has both a central and a peripheral action. The more significant action is probably peripheral and is dependent on paralysis of the parasympathetic nerve endings or myoneural junctions. The central stimulation is greatly offset by this paralysis. Here, again, the size of the dose is of prime importance. In small doses the heart rate is considerably slowed, presumably by stimulation of the vagal centers. In larger doses the rate is increased. This is due to paralysis of the parasympathetic nerve endings. If the dose is somewhere in between these two, no change may be noted. In most human adults $\frac{1}{100}$ grain (0.6 mg.) [2] usually slows the heart; in a few it hastens it, and in others causes no change.

Pilocarpine.—This acts on the myoneural junctions of the parasympathetic nerves. It excites the tissues that are supplied by these nerves to increased activity, in contrast with epinephrine, which excites tissues supplied by the sympathetic nerves. All anatomic evidence indicates that the skin is innervated by branches from the thoracolumbar group, yet pilocarpine produces profuse sweating.

This discrepancy is ingeniously explained by Langley.[1] Phylogenetically and embryologically, the parasympathetic system and the dermal coating of the organism are older than the sympathetic system. These were exposed to similar environmental conditions (chemical and physical). Consequently, their reaction in common became so fixed through their original response that they afterwards retained it, even when, at a later period, the sympathetic nerve fibers reached the dermal cells. This results in nerve stimulation producing one type of reaction and chemical stimulation another.

CLINICAL INVESTIGATION OF THE AUTONOMIC SYSTEM

It occurred to Eppinger and Hess [3] that the physiologic balance between the thoracolumbar and bulbosacral branches of the autonomic might become disturbed under pathologic conditions. It is possible that certain toxins or hormones might be liberated into the blood stream so as to give rise to a constant stimulation of one or the other system. This would lead, on the one hand, to a syndrome called sympatheticotonia and, on the other, to vagotonia. They modify this syndrome to include cases in which the symptoms of a given organ or group of organs supplied by either thoracolumbar or bulbosacral nerves predominate. A large group of cases was cited to demonstrate this thesis.

To demonstrate the hyperactive vagus in the vagotonic group, they employed pharmacologic tests. Epinephrine, in a case in which the vagus was hyperactive, would produce no reaction, whereas considerable reaction would follow the injection of atropine. Pilocarpine, in such a case, would cause a violent generalized

2. Rudolf, R. O., and Bulmer, F. M. R.: Am. J. M. Sc. **168**:641, 1924.

3. Eppinger and Hess: Vagotonia, monograph 20, New York, Nerv. & Ment. Dis. Pub. Company, 1915.

response. Conversely, patients with hyperactive sympathetic systems would react little or not at all to pilocarpine and violently to epinephrine.

Platz,[4] studying autonomic tonus in man, used epinephrine hydrochloride, pilocarpine hydrochloride and atropine sulphate subcutaneously in the following doses: from 0.75 to 1 mg. (± 16.2 minims, 1:1,000 solution) of epinephrine hydrochloride, from 0.5 to 1 mg. (± 1/70 grain) of atropine and 0.01 Gm. (± 1/6 grain) pilocarpine.

Goetsch, using 0.5 cc. of epinephrine hydrochloride,[5] got vigorous reactions in a high percentage of cases of hyperthyroidism.

Peabody,[6] using epinephrine in similar doses, employed this method of studying the so-called "irritable heart" in "effort syndrome" in a series of sixty-five cases. He obtained similar positive results in 60 per cent, suggestive in 10 per cent and negative in 30 per cent.

Clough,[7] in 1920, made a careful study of this reaction in his clinic. He divided his patients into four groups, using a dose of 1 cc. of epinephrine hydrochloride.[8] He arrived at the following conclusions:

Group 1 (Negative Reaction).—These cases showed a rise of less than 15 mm. of mercury in systolic blood pressure, less than 20 mm. of mercury rise in pulse pressure, and no subjective symptoms. This occurred in 30 per cent of thirty-two normal persons.

Group 2 (Moderate Reaction).—These patients had a rise of from 15 to 30 mm. of mercury in systolic blood pressure, from 25 to 40 mm. of mercury in pulse pressure, a pulse rise of 10 to 20, and some slight subjective symptoms. This occurred in 50 per cent of thirty-two normal persons.

Group 3 (Marked Reaction).—These patients had a rise in systolic blood pressure of from 30 to 50 mm. of mercury, some fall in diastolic pressure, a rise in pulse pressure of from 40 to 60 mm. of mercury, and considerable subjective reaction. This was seen in 12.5 per cent of thirty-two normal persons.

Group 4 (Very Marked Reaction).—These patients showed a rise of from 50 to 100 mm. of mercury in systolic blood pressure and a rise of from 50 to 100 mm. in pulse pressure. This occurred in two of the thirty-two normal persons.

To summarize, 68 per cent of normal persons given this dosage showed a moderate to marked reaction to epinephrine and 32 per cent showed none. Clough also noticed that patients having hypertension showed a more marked reaction than those having hypotension.

Aschner[8] noted only a slight rise in systolic blood pressure after the injection of epinephrine hydrochloride in cases of myxedema. Hetenyi and Sumegi[9] obtained results similar to those of Clough in cases of hypertension. Positive reactions were noted by De Angelis[10] in a large percentage of children. Jure and Svenson believe that the response varies somewhat in relation to other

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4. Platz, O.: Klin. Wchnschr. **2**:1413, 1923.

5. The preparation of epinephrine used in these experiments was adrenalin chloride (1:1,000) prepared by Parke, Davis & Co.

6. Peabody, F. W.: Epinephrine and Soldier's Heart, J. A. M. A. **71**:1912 (Dec. 7) 1918.

7. Clough, P. W.: Bull. Johns Hopkins Hosp. **31**:266, 1920.

8. Aschner, B.: Klin. Wchnschr. **2**:1060, 1923.

9. Hetenyi, S., and Sumegi, S.: Klin. Wchnschr. **3**:188, 1924.

10. De Angelis, F.: Pediatria **29**:542 (June 15) 1921; abstracted in J. A. M. A. **77**:822 (Sept. 3) 1921.

physiologic functions, such as sleep, eating and time of day. Weinberg [11] states that 0.001 cc. of 1 per cent solution of epinephrine hydrochloride per kilogram of body weight per minute of continuous intravenous flow may cause a moderate rise in blood pressure. Dresel,[12] Kylin [13] and others believe that subcutaneous and intravenous results are relatively the same. For purposes of experiment, subcutaneous injection is superior because of the more gradual and more sustained rise in blood pressure. Collip [14] calls attention to a fact previously mentioned in relation to animals, namely, that the response is dependent on such factors as blood pressure levels and any accident or event that might alter this level, as well as the size of the dose and the rate at which it is given.

Many of the negative responses and the falls in systolic blood pressure, possibly may be due to the high dilution of the drug that must exist before the full amount has had a chance to enter the blood stream. The sustained falls may be explained on a similar basis, i. e., slow absorption of great dilution at any given moment. Lehmann,[15] performing tests in 100 cases with the three drugs suggested by Eppinger and Hess, denied that they were useful as an index of the tonus of the autonomic system. In his experiments, the results were inconsistent and contradictory, many patients reacting violently to both sets of drugs and others to neither.

Lutz and Wyman [16] found the blood pressure in animals to be unreliable in the assaying of epinephrine. After repeated doses of equal strength they observed an increasing reaction. Using pharmacodynamic tests such as these, Langfeldt,[17] Claude, Santenoise and Targowla,[18] Russetsky [19] and others [20] have found evidence of either vagotonia or sympatheticotonia in various mental diseases.

In addition to these, much literature [21] has accumulated on the identification of the vagotonic syndrome and its significance in other diseases. Few careful critical analyses, however, have been attempted.

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11. Weinberg: Klin. Wchnschr. **4**:967 (May 14) 1925; abstracted in J. A. M. A. **85**:232 (July 18) 1925.

12. Dresel, K.: Ztschr. f. klin. Med. **101**:70, 1924.

13. Kylin, E.: Med. Klin. **21**:171, 1925.

14. Collip, C. P.: Endocrinology **6**:402, 1922.

15. Lehmann, G.: Deutsche med. Wchnschr. **47**:41, 1921.

16. Lutz, B. R., and Wyman, L. C.: Am. J. Physiol. **72**:488, 1925.

17. Langfeldt, G.: Norsk Mag. f. Laegevidensk. **86**:1 (Jan.) 1925; abstracted in J. A. M. A. **84**:1012 (March 28) 1925.

18. Claude, H.; Santenoise, D., and Targowla, Rene: Attempt at Biologic Diagnosis of States of Excitement and Depression, Arch. Neurol. & Psychiat. **13**: 729 (June) 1925.

19. Russetsky, J. J.: Ztschr. f. d. ges. Neurol. u. Psychiat. **93**:381, 1924; abstracted in Arch. Neurol. & Psychiat. **13**:629, 1925.

20. Ballif, L., and Rosen, H.: Compt. rend. Soc. de biol. **91**:767, 1924; abstracted in J. A. M. A. **83**:1036 (Sept. 27) 1924.

21. Louros, N. C.: Zentralbl. f. Gynäk. **48**:1903, 1924. Loeper, M., and Turpin, R.: Progrès méd. **38**:626, 1923. Schaller, W. F.: Pathologic Physiology of Involuntary Nervous System, J. A. M. A. **83**:163 (July 19) 1924. Staemmler, M.: Beitr. z. path. Anat. u. z. allg. Pathol. **71**:503, 1923; quoted from Practical Med. Series Year Book Publishers, Chicago **8**:186, 1923. Laignel-Lavastine: Progrès méd. **39**:81, 1924. Lyon, D. M.: Quart. J. Med. **17**:19, 1923.

It may then be said that many observers have noted the physiologic response to injections of epinephrine hydrochloride. It is apparent that many factors alter this response and that it is only when fixed, standard control conditions are used that comparable results are obtained. Many clinical observations of response to the various common autonomic drugs have been made and, though these have not always been carefully and critically analyzed, it is strongly suggested that (1) there are a series of reactions exhibited by normal individuals that might be considered as "control responses," and that (2) autonomic imbalance is associated with many clinical syndromes.

EXPERIMENTAL STUDIES

With the foregoing work as a guide, pharmacologic tests were made on about 160 persons, the purpose being to note the autonomic reaction of normal persons and of those suffering especially from gastric neuroses and ulcers. A control series of forty-eight cases was studied first.

After numerous experiments with pilocarpine, it was decided to discontinue its use. The reactions, on the whole, were unsatisfactory. The exact amount of sweating, salivation and autonomic reaction could not be determined quantitatively. Interpretation on the basis of impression is too loose to be of any value in a group of experiments that had for their purpose quantitative determinations.

Atropine also was finally discontinued for similar reasons. Variability in reaction to atropine might be a criterion more of the relative responses of the central or peripheral portions of the vagus than of the balance that existed between the vagus and the thoracolumbar groups. Furthermore, the time required for such experiments and the necessity in some cases at least, for repetition, if any definite conclusions were to be reached, made it inadvisable to use this drug.

It was consequently decided to study intensively the cardiovascular reaction after injections of epinephrine hydrochloride. In making the tests, our aim was to obtain as far as possible concrete facts, the accuracy of which depended as little as possible on subjective estimates by either the patient or observer. In all the tests, qualitative observations were made (palpitation, tremor, pallor, diaphoresis and other subjective and objective responses being noted), but to these little value is attached.

TECHNIC

The procedure followed in making the tests was the same in all cases, though added experience made it increasingly possible to avoid complications due to some cause other than the drug itself. A special room was used in which privacy could be maintained. The patient was requested not to talk more than was necessary to give the information requested. Readings of blood pressure, pulse and respiration were taken and charted until a level was maintained, before the epinephrine hydrochloride was injected. The dose as finally determined was governed by body weight; 0.243 minims (0.0150 cc.) of epi-

nephrine hydrochloride[5] per kilogram of body weight was injected subcutaneously. Readings of blood pressure and pulse were taken every three minutes following the injection for a period varying between fifty and seventy-five minutes. In all cases the height of the reaction was passed within an hour. The length of time involved in the reaction varied greatly, but in all tests the readings were continued until both blood pressure and pulse were returning to normal.

Precautions were taken against interruptions or conversation that might disturb or excite the patient during the test. In this connection, it was observed that, during tests lasting from one to two hours, the causes, both physical and psychic, of temporary rises of blood pressure and pulse might be numerous, e. g., strong emotion, a difficult effort to concentrate, sudden or severe pain, the desire to urinate, etc. The administration of epinephrine seemed to make the blood pressure and, to a lesser extent, the pulse more sensitive to both physical and psychic stimuli.

Several criticisms of the method must be considered. It seemed possible that persons weighing little, who received smaller doses of epinephrine would react less vigorously than heavy persons with larger doses. A small person having an ulcer was given a dose in proportion to body weight (13 minims [0.80 cc.] of epinephrine hydrochloride). A typical negative result or lack of response was noted. The same person was given a considerably large dose (19 minims) several days later with a similar response. It is probable that a sufficiently large dose would cause a vigorous reaction. This, however, was not within the limits of the experimental doses. Further, the persons having a moderately severe reaction repeatedly had such a reaction, although the exact level reached in pulse or blood pressure might be variable. This was equally true of those having other types of reaction. In other words, it was found that each person gave the same type of reaction to repeated doses of epinephrine, although the actual readings of pulse and blood pressure varied. Since every effort was made to standardize the method of injection and, as previously recorded by Kylin, intravenous and subcutaneous injections, although absolutely different, were relatively similar in effect, any slight error arising from faulty technic of injection could be discounted. The doses given in these experiments were greater than the vasodilator dose, and the precautions taken to hurry the drug into the blood stream make error unlikely, because of the reversal of reaction in small doses.

RESULTS

Lyon[23] reported a rise in systolic blood pressure after an amount as small as 0.1 cc. of epinephrine hydrochloride had been injected subcutaneously. This was not our experience. In twelve controls used in this series, the injection of 0.3 cc. produced a moderate rise in only one case. Lyon observed three patients who had a slight fall in systolic blood pressure preceding the rise. This was noted in only one case in this series. Late rises have been noted in individuals who were restless from discomfort or because of a desire to go to stool or urinate. The effects of epinephrine on blood pressure seldom lasted longer than an hour. In one case there was a sustained rise of one and one-half hours.

It was observed in this series that, after initial prompt rises in blood pressure with subsequent falls such as occurred in the first few minutes after injection, there was a secondary rise, which was attributed to the action of epinephrine of endogenous origin, the result of marked sympathetic stimulation.

The initial blood pressure (taken before the injection of epinephrine) is possibly a factor in influencing the rise in systolic pressure after the injection of

epinephrine. In this series, it was not found that a high percentage of "marked" and "very marked" reactions occurred in those with the initial highest pressure. The initial blood pressure readings are given in table 1.

TABLE 1.—*Initial Blood Pressure Readings*

	Per Cent		Per Cent
90 to 110	60	120 to 130	10
110 to 115	14	130 to 140	8
115 to 120	6	140 to 150	3

A comparison of the responses to epinephrine is given in table 2.

TABLE 2.—*Comparison of Responses to Epinephrine*

Rise in Systolic Blood Pressure	*Present Series* Per Cent	*Clough* Per Cent	*D. M. Lyon* Per Cent
Negative — 0 — 15 mm. Hg	8	30	32
Moderate — 15 — 30 mm. Hg	56	50	30
Marked — 30 — 50 mm. Hg	28	12.5	34
Very marked — 50 — 100 mm. Hg	8	7.5	4

It is evident from tables 1 and 2 that the only significant dissimilarities in the three series are in the so-called negative group, in which the present series shows a smaller percentage than the other two. In this series the cases were selected carefully to avoid as far as possible those showing autonomic derangement.

Lyon refers to two types of rise in systolic blood pressure: (1) a quick response and (2) a delayed response. In his group the greatest rise took place in the second ten-minute period, and then a gradual fall occurred. The patients having a sudden rise also would have a prompt fall. These results correspond roughly with our own, as set forth here. The time when the greatest systolic rise took place is shown in table 3.

TABLE 3.—*Time When Greatest Systolic Rise Occurred*

Minutes	Per Cent	Minutes	Per Cent
First 6	25	30 to 45	14
6 to 15	14	Plus 45	6
15 to 30	42		

The duration in minutes of 10 per cent systolic rise is given in table 4.

TABLE 4.—*Duration of Ten Per Cent Systolic Rise*

Minutes	Per Cent	Minutes	Per Cent
Less than 15	20	30 to 45	24
15 to 30	25	45 to 60	31

About three fourths of the patients had returned to normal within forty-five minutes.

The diastolic blood pressure usually fell after the injection of epinephrine but, if the systolic rise was great and abrupt, there was also a diastolic rise. In 12 per cent (two cases, a duration of more than fifteen minutes) there was a rise

with no fall below the initial pressure. In 6 per cent there was neither rise nor fall. In the remainder (82 per cent) a fall occurred immediately or shortly after the injection.

The fall in diastolic blood pressure is difficult to explain. It is possible that the exaggerated impulse is responsible, for the exact point where the reading can be made in diastolic pressure depends somewhat on the force of the impulse. The sharp, intense but brief cardiac cycle, with a relatively longer diastole, may result in a greater drop in arterial pressure between beats. The fall in diastolic blood pressure in millimeters of mercury is given in table 5.

TABLE 5.—*Fall in Diastolic Blood Pressure*

Millimeters	Per Cent	Millimeters	Per Cent
0 to 5	14	20 to 25	8
5 to 10	22	25 to 30	8
10 to 15	20	30 to 35	3
15 to 20	25		

The rise in pulse rate, as found by Lyon, varied between 10 and 25 points from psychic causes. This was also our experience. By means of suggestion, embarrassment or concentration, fluctuations in pulse rate and, to a lesser extent, in blood pressure resulted, hence, the precautions previously mentioned. Our results are shown in table 6.

TABLE 6.—*Pulse Rate in Authors' Cases*

Beats	Per Cent	Beats	Per Cent
1 to 10	25	20 to 30	25
10 to 20	42	30 to 48	8

No falls were noted. The duration in minutes of 10 per cent pulse rise is shown in table 7.

TABLE 7.—*Duration of Ten Per Cent Pulse Rise in Authors' Cases*

Minutes	Per Cent	Minutes	Per Cent
0 to 15	17	Plus 45	45
15 to 30	17	Without a rise of 10 per cent	11
30 to 45	8		

In addition to the quantitative measurements given above, qualitative responses also were noted. The reactions to the injection of epinephrine were emotional changes, palpitation, tremor, diaphoresis and pallor. They occurred in the following percentage of cases: feeling of anxiety, 35; palpitation, 90; tremor, 95; pallor, 63; diaphoresis, 17.

SUMMARY

The data of this study agree essentially with those given by Clough and by Lyon. Following the injection of epinephrine, there is an elevation in systolic blood pressure in a high percentage of normal persons. There is usually a fall in diastolic blood pressure and a rise in pulse rate, accompanied by palpitation, which roughly parallels in intensity the elevation in blood pressure.

AUTONOMIC SYMPTOMS AND SIGNS

Many of the so-called symptoms and signs of autonomic imbalance were investigated. Our original notes included a long list of symptoms and signs of autonomic imbalance obtained from the literature that were said to be evidences of abnormal autonomic function. Many of these were indefinite and difficult to determine. In the summary below we have included those that were reasonably definite and simple, and frequent enough for comparison. In our controls, the following symptoms were found in a percentage of 3 or over: constipation (repeated or chronic), 35; diarrhea (repeated or chronic), 18; mucous colitis (at any time), 5; flushing, 5; palpitation, 20; cold hands and feet (out of proportion to remainder of body), 27; cyanosed extremities, 27; dyspnea, 15; polyuria, 5; urticaria, 3.

The following autonomic signs also were found in this group: epiphora, 5; hyperhidrosis, 20; pallor, 27; Aschner's sign, 18; sinus arrhythmia, 20; tremor, 25.

Our inference from these figures is that the signs and symptoms mentioned are of considerable frequency in controls and indicate a normal response to the interoceptive demands of the organism. It is only when the abnormalities noted are well above the percentage for the controls that they may be considered of pathologic significance.

CONCLUSION

A group of normal persons under standard conditions respond more or less consistently to the injection of epinephrine hydrochloride. Further, certain autonomic functions, qualitatively determined, indicate that there is a normal of broad latitude. It must follow, therefore, that persons, or groups of persons, who widely deviate from such standards are abnormal. Lacking specific fundamental anatomic and physiologic information, we can say little more than that this abnormality is evidence of a general autonomic imbalance.

PART II. GASTRODUODENAL ULCERS AND AUTONOMIC IMBALANCE

It is our purpose now to review the accumulated evidence of neurogenic dysfunction in its relation to changes in the gastric mucous membrane. We shall present further the evidence of autonomic imbalance that we have found to exist in cases of gastroduodenal ulcers and which indicates that such ulcers, according to the degree of this imbalance, may be divided into acute and chronic lesions. Supplementing the observations of previous experimenters with our own, we shall describe an hypothesis of the pathologic mechanism involved in the production of mucosal erosions, with ultimate chronicity.

With the exception of the work of G. A. Friedman, little of note has been written in English on this subject. Workers in continental Europe, chiefly in Germany, have considered the problem for many years.

ANATOMY AND PHYSIOLOGY OF THE STOMACH

A brief survey of the anatomic and physiologic factors involved is necessary in any discussion of the relationship between the autonomic nervous system and gastric disorders.

ANATOMY

There is sufficient embryologic, anatomic and physiologic evidence to indicate that the stomach and duodenal cap (or the first part of the duodenum) may be considered as a unit in the digestive system. The stomach and this portion of the duodenum have, in addition, the common factor of being favorite sites for chronic ulcerations. In this discussion they will be considered together and, although therapeutically or surgically they may present different aspects, differentiation here will be unnecessary.

Since much of the acceptable work on the stomach has been done on dogs, a few words on the anatomic relationship existing between man and the dog may be advisable. There is much similarity between the distribution of the vagus in man and in the dog. In both, section low in the esophagus reveals the left vagus going anteriorily and the right vagus posteriorly. Small branches are given off in the lower esophagus. The left vagus supplies branches to the cardia and extends along the lesser curvature, giving a branch to the antrum pylorus. The right vagus extends along the lesser curvature also, but more posteriorly. The greater portion terminates in the semilunar ganglion. It innervates in its course the posterior wall of the stomach.

There is no evidence that sympathetic motor fibers reach the esophagus. The motor supply is apparently entirely from the vagus. It acts both in a motor and inhibitory capacity in the esophagus. The incisura cardiaca is the upper limit of the innervation of the thoracolumbar system. Below this point the vagus and sympathetic function together; above, the vagus acts alone. The cells of Auerbach's plexus are best considered as motor cells which give rise to motor nerves that respond to vagus impulse. The mesenteric ganglia (Gaskell[22]), on the other hand, give rise to fibers that apparently respond only to thoracolumbar stimulation. The vagus and the sympathetic together supply the remainder of the stomach and small intestine, including the pylorus.

Shawe[23] described the connection between the inferior and middle cervical sympathetic ganglia and vagus nerves through a branch of the recurrent laryngeal nerve. The significance of this observation is not known. There is a communication between the right and left vagus on the anterior surface of the esophagus. Section of one vagus nerve above this communication, therefore, causes no notable dysfunction of the stomach. No nerve communication exists in the stomach itself.

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22. Gaskell, W. H.: The Involuntary Nervous System (Monographs on Physiology), New York, Longmans Green & Co., 1916.

23. Shawe, R. C.: Lancet **1**:640, 1924.

The portion of the stomach supplied by the anterior nerve is not affected by stimulation of the posterior nerve. Ross suggests the possibility of separate tracts corresponding to different functional divisions of the stomach, with possible separate centers in the brain. This is questionable.

Aschoff,[24] in discussing the factors in the stomach that determine whether a given mucosal erosion or hemorrhagic area will ulcerate and become the seat of a chronic low-grade inflammatory lesion, subdivides the stomach into two parts, pars digestoria and pars egestoria. The former consists of the portion in which active digestion takes place, and the latter of the ejaculatory portion (gastric pathway and pyloric canal). This transporting area is poorly supplied with folds of mucous membrane; the convolutions are widely separated. The gastric pathway is found in the superior portion of the stomach, running near, although not identical with, the lesser curvature. It is limited to four longitudinal folds spreading out, fan-shaped, into the pyloric canal below. The latter is sparsely supplied with folds. The boundary between the gastric pathway and the rest of the stomach is indicated by the course of the fibrae obliquae muscle (sphincter muscle of the fundus portion against the rest of the stomach). The pars digestoria presents a threefold division, namely, the fornix, the corpus and the vestibulum. The latter is to be differentiated from the pylorus by a different type of mucosal gland.

Aschoff [24] differentiated acute from chronic ulcers and emphasized that, among other things, the part of the stomach most actively engaged in the transportation of food is the area most likely to be the site of chronic ulceration. He regards the pathogenesis of chronicity as follows. If an eroded area is in a portion of the stomach richly supplied with mucosal folds, there is an overfolding or overlaying of neighboring folds, with subsequent rapid repair. Should the lesion occur in a portion sparsely supplied, such overlaying and protection are impossible. Should the erosion, in addition, be in a portion in which there is active transit of food and swallowed infectious material, then healing becomes especially difficult.

BLOOD SUPPLY

The distribution of the blood vessels of the stomach is also a factor in determining whether a given mucosal erosion will disappear or will persist and become a chronic lesion.

The branches of the right and left epiploic arteries leaving the greater curvature quickly penetrate the stomach wall in the fundus region and there ramify. The fundus also receives branches of the gastric artery on the lesser curvature at the boundary between the gastric pathway and the fundus region. The fundus thus has a double blood supply and is nourished from branches of both gastric and gastro-epiploic arteries. The gastric pathway, on the other hand, is supplied by recurrent branches of the gastric and pyloric arteries. It is this area that is especially liable to harbor the foci of anemia.

Ligations in the region of the gastro-epiploic arteries have no recognizable influence on the fundus mucosa, whereas ligations in the gastric or pyloric arteries, or in both vessels, lead to localized nutritional disturbance. The significance of these peculiarities of blood supply is readily appreciated when it is seen that the site at which anemia is most likely to occur is that at which ulcers are most commonly found.

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24. Aschoff, L.: Lectures on Pathology, New York, Paul B. Hoeber, p. 279, 1924.

PHYSIOLOGY

Innervation.—Impulses of the stomach are motor, inhibitory and sensory. Secretion may be considered as a special type of motor function. Although the stomach possesses a great deal of intrinsic activity and a form of independence, it has much less function than the ileum. It cannot be said, because the organ has a double innervation, that the vagus is constantly motor or the sympathetic constantly inhibitory. Apparently the vagus is predominantly motor and is the chief motor nerve of the stomach, even though the sympathetic may also have motor function.

Both the vagus and the splanchnic nerves are involved in sensation. The afferent impulse is said to travel through the splanchnics and to have its effect in response by its action on the vagus centers (Rost [25]). Stimulation of the duodenum causes a sensation of nausea, dizziness, pressure, headache and syncope (Keeton [26]).

Splanchnic (Sympathetic) Nerves: Few essential facts are known of the function of the splanchnic nerves. On sympathetic stimulation alone the stomach is apparently dormant. There is little differentiation in the tone of the pyloric and fundus portions of the stomach under these circumstances. According to Carlson and Litt,[27] and Gaskell,[22] stimulation of the splanchnic nerves may cause contraction of the pylorus and duodenal region.

Splanchnic stimulation, according to Contejean, causes contraction of all the musculature of the stomach, especially the circular muscles. Page May believed that splanchnic control is neither stimulating nor inhibitory to the musculature, but has some effect on the muscle through its action on the blood vessels. Cannon, Bayliss, Starling and Klee believe that splanchnic elimination enables the vagus effect to be more obvious. Vagus accentuation, in the absence of splanchnic innervation, is also noted by Modrakowsky and Sabat, Stierlin, Nieden, Könnicke and Meyer. These observations further indicate the predominating motor influence of the vagus. By the use of small quantities of ergotamine, even greater effects were elicited on stimulation of the vagus. Excessive stimulation of the vagus occasionally causes delayed emptying and vomiting through spasm of the pylorus.

Motor Function of the Vagus: The vagus nerve is said to carry both excitatory and inhibitory impulses.

Stimulation of the peripheral stump is said [23] first to cause inhibition and then increase of motility. Bilateral section causes slowing of movements. Klee stated that stimulation of the vagus produced vomiting. This was prevented when the

25. Rost, F.: Pathological Physiology of Surgical Diseases, translated by S. P. Reimann, Philadelphia, P. Blakiston's Son & Co., 1923, p. 37.

26. Keeton, R. W.: Nausea and Related Sensations Elicited by Duodenal Stimulation, Arch. Int. Med. **35**:687 (June) 1925.

27. Carlson, A. J., and Litt, S.: Visceral Nervous System, Arch. Int. Med. **33**:281 (March) 1924.

splanchnic nerves were cut. Borchers and Borgers say that the vagus has no influence on stomach motility. Konnicke and Meyer say that in dogs, after bilateral section of the vagus, there is loss of tone, decreased peristalsis and delayed emptying time. This is said to be even more marked if there is a pathologic narrowing at the pylorus or duodenum. Cannon, Magnus, Stierlin, Klee, Modrakowsky, Sabat and Nieden agree with this observation. After the removal of the sympathetic nerve, the action of the vagus becomes predominant and there is deeper peristalsis and hastened emptying time. Nieden also saw increased tonicity after such a procedure. Borchers obtained negative results on a stomach removed from the body after stimulation of the vagus. Klee, by means of section through the brain stem below the tentorium, demonstrated similar results. By eliminating anesthesia (which, of course, has a specific influence), he showed that stimulation of the central end resulted in greatly increased motility and peristalsis and shortening of the emptying time. Section of the vagus in the neck, below the point where the fibers of the heart come off, causes slowing of stomach motility, increased hydrochloric acid, pyloric spasm and gastric stasis (Rost). Subdiaphragmatic section of the vagus causes less distortion, presumably because the important branches of the stomach have come off above this point.

Stahnke[28] has developed a technic that is praiseworthy. By means of a small olive-shaped electrode, which he introduces into a conscious animal, he has been able to obtain results that are not complicated by surgical traumatism or anesthesia. He has demonstrated that such stimulation is not painful and, by means of dissection and the roentgen ray, he has determined the sites in the course of the vagus best suited for stimulation. This, he believes, is in the lower end of the esophagus. By means of shorter and longer stimulation of this portion, he demonstrates the effect of innervation of the vagus. To prove that his observations are not the result of direct stimulation of the mucous membrane of the stomach wall, he performed the following experiment: A dog previously vagotomized was permitted to recover from the operation. The roentgenograms showed a large, dilated, slowly emptying stomach, with little peristalsis. Stimulating the esophagus in this animal at the point mentioned above did not produce any change in the tone, size, motility or emptying time of the stomach. Roentgenograms of a normal dog, stimulated through the esophagus in the manner described above showed increased tonicity, deeper peristalsis and immediate evacuation. When stimulation is stopped, the function returns to normal. Stahnke often noticed after such stimulation contractions severe enough to obliterate completely a part of the stomach into two separate shadow forms. Stronger stimulation caused this to become even more marked. Hour-glass stomach was not seen. Closure of the pylorus was apparently independent of vagus stimulation.

The vagus nerve, under favorable physiologic conditions, has been shown to be the chief motor nerve of the greater part of the stomach. In addition to other functions, it has a pressor effect on tone and peristalsis.

Pylorus.—Cannon,[29] in 1904, described his mechanism for the closure of the pylorus, which is as follows: Acid on the stomach side of the pylorus opens it and acid on the duodenal side closes it. This has been challenged repeatedly.

28. Stahnke, E.: Arch. f. klin. Chir. **132**:1, 1924.
29. Cannon: Mechanical Factors of Digestion, 1911, p. 96.

Water leaves the stomach faster than acid, and weak acid faster than strong acids (Morse[30]). In infants, when the food contents are rendered either acid or alkaline the gastric evacuation is delayed (Cowie and Lyon[30]). Opening and closing seem to be more closely dependent on a periodic tonus rhythm of the wall of the stomach. It is apparently more potent than the acidity (Luckhart and Carlson[30]).

Rhythmic contraction of the pylorus results from stimulation of the peripheral ends of both vagi and splanchnic nerves. There is an inhibitory effect after the administration of epinephrine (Thomas and Wheelon[30]). Stahnke and Seyerlein,[31]

31. Stahnke, E., and Seyerlein: München. med. Wchnschr. **72**:334, 1925.

using the method devised for dogs, experimented on man. They observed that stimulation of the vagus through the esophagus caused increased tonus and peristalsis, without subjective symptoms, just as had been observed previously in animals. They concluded that the duodenal bulb is functionally a part of the stomach. Opening and closure of the valve, in their estimation, depended on the intensity of the stimulus, probably through its action in rhythm.

The experiments of Carlson and Litt[27] throw more light on the much disputed question of pyloric innervation. A spontaneous rhythm of the pylorus exists at a rate of three or four waves per minute in dogs. Section of both vagi may have no effect either in producing spasm or in alleviating it. However, section of the vagi may be followed by prolonged relaxation of a hypertonic pylorus and prolonged contraction of an atonic pylorus. Tetanization of the peripheral end of the cut vagi always induces contraction of an atonic, and prolonged relaxation of a hypertonic or spastic, pylorus Carlson and Litt conclude that the vagi may send both motor and inhibitory impulses to the pylorus. Protracted pyloric spasm may, in special cases, be due to hyperactivity of the vagus motor system. Protracted atonicity also may be due to hyperactivity of the vagus. In this case, however, they are probably due to the inhibitory mechanism. As the authors properly suggest, this inhibitory influence of the vagus may merely represent reflex activity on the part of the splanchnic nerves in response to vagal stimulation; splanchnic stimulation in itself gives similar results. Pyloric spasm has been seen as a result of injury to the urinary bladder, ureters, kidneys, large and small intestines, mesentery and parietal peritoneum. These responses are present even after section of both vagus nerves. Epinephrine induced contraction of the pylorus. The cardia and the pylorus act similarly in their response to visceral disturbances.

Tetanization of the central end of the sciatic nerve produces temporary spasm of the pylorus, even after section of both vagi.

Anything that stimulates or injures the mucosa of the duodenum can produce pyloric spasm. This is not limited to acid substances, as was previously believed. In addition, acid in contact with the antrum mucosa does not relax the pylorus.

From these data on the response of the pylorus to both thoracolumbar and vagus stimulation, we may conclude that the pylorus mechanism is doubly controlled or regulated. It possesses, in addition, the usual intrinsic capability of smooth muscle. Practically, this is significant. Functional derangement of the pylorus may follow central or peripheral irritation. Mechanical, chemical, toxic and infectious as well as psychic disturbances (central) may be causative agents. Peripheral agents of a similar sort (with the exception of psychic), such as visceral disease,

30. Quoted by Carlson and Litt (footnote 27).

infections from biliary tract disease; congenital bands, cystitis, pyelitis, also may be etiologic factors. This may possibly be due to overflow into the segmental level innervating the pylorus, thereby giving rise to spasm and possibly to trophic disorders in this region.

The relative importance of the central and peripheral irritation is difficult to assign. It is possible that visceral stimuli may act directly through thoracolumbar overflow on the pylorus, or indirectly through central stimuli (on the vagal center). The high incidence of psychic disturbance with subsequent derangement of the stomach indicates that the central factor, by direct or indirect stimulation, is of major significance.

Motility.—The empty stomach ordinarily is quiescent. Every one and one-half or two hours there is activity lasting ten minutes, approximately, and resulting in the discharge of the accumulated contents.

The waves of contraction become deeper as they approach the pylorus (Rost). During active digestion, a contraction wave in the human stomach is seen at the rate of every twenty-two seconds. Ordinarily, slight mechanical stimulation induces movement. The independence of the stomach is best demonstrated in its motility. Although vagus and splanchnic innervation can, under certain circumstances, accentuate activity, the isolated organ easily may maintain its tone as well as its motion (Ivy[32]). Surgically produced ulcers in an isolated stomach are capable of causing spasm and retention. This was more marked, however, when the exogenous innervation was intact. Ivy distinguishes between the contractions that are due to intrinsic properties of the muscle wall and those due to exogenous innervation. Carlson and Patterson[33] have demonstrated that hunger contractions in the stomach of the frog are dependent on intrinsic innervation. This has been noted also in dogs. Here too, however, the presence of the outlying nerves augmented motility. Gaskell believes that no real distinction can be shown between intrinsic and extrinsic innervation in the case of the splanchnic nerves. According to him, lateral, collateral and outlying motor cells are all migrations from a common central source. Motility of the stomach depends not only on local or neurogenic stimuli, but also on general bodily alterations. Motility can be decreased wholly or in part by violent exercise, raising the carbon dioxide content of the inspired air and fairly large doses of sodium bicarbonate. Excessive smoking and sometimes subcutaneous injection of epinephrine also impede motility. Insulin, on the other hand, is said to increase peristalsis (Dickson and Wilson[34]).

Tonus and peristalsis are apparently separate motor processes. Acetyl choline is said to increase the latter only (Bickel[35]), leaving the former unmodified. As choline and epinephrine are pharmacologic antagonists, Magnus[36] concludes that the former acts on the gastro-intestinal system by means of Auerbach's plexus. Atropine prevents the action of choline. The peristalsis produced is apparently normal as compared with the violent reaction produced by pilocarpine and physostigmine.

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32. Quoted by Thomas, J. E., and Kurtz, A.: Am. J. Physiol. **76**:606, 1926.
33. Patterson, T. L.: Am. J. Physiol. **53**:293, 1920.
34. Dickson, W. H., and Wilson, M. J.: J. Pharm. & Exper. Therap. **24**:33, 1924.
35. Bickel, A.: Klin. Wchnschr. (Berlin) **4**:200, 1925.
36. Magnus, R.: München. med. Wchnschr. **72**:249, 1925.

The independence of tone and peristalsis also is seen in roentgenograms of stomachs showing retention. These often have deep peristaltic incisures and still are considerably dilated. Usually, however, dilatation and atonicity, with the absence of peristalsis, are correlated.

It is thus experimentally demonstrable that the stomach is intrinsically capable of maintaining tone and motility. Outlying nerves and centers have a regulatory function, helping the organ to adjust itself better to unusual demands and aiding it in being in rapport with the general physiologic economy (defense or flight). Beside the neurogenous influences, there are also chemical or hormonal ones that markedly influence the function of the stomach. From pharmacologic and clinical data, it seems possible that peristalsis and tone may be independent functions, although they are commonly correlated. These considerations are of significance because chronic gastroduodenal ulcerations are lesions that make demands on both extrinsic and intrinsic function. They are so placed as to cause the many aberrant responses as a result of the indigenous capabilities. In addition, the exogenous influences later will be shown to be highly important, not only because of their influence on the functions already mentioned, but because of their influence on the nutrition of the tissues or the trophic elements. It is apparent that great caution always must be observed in drawing inferences concerning gastric behavior under conditions of experimental or clinical alterations in the nerves.

Secretion.—Pawlow established the fact that the central action of the vagus influenced secretion.

This was confirmed by others (Axenfeld, Contejeau and Schneyer) in birds and other animals. Uschakows, stimulating the exposed and cut vagi in the neck, produced increased secretion in an experimental fistula of the stomach. This showed itself after a latent period. Babkin believes that this latent period represents the time necessary to fatigue the inhibitory fibers before the secretory fibers become effective. Cristina made histologic studies of the stomach immediately after direct stimulation of the vagus. He found evidence of excessive secretory activity, as seen in the increase of vacuoles as well as in the fuchsinophilic particles in all cells. Stahnke[38] demonstrated a great outflow of stomach juices with an increased digestive ability after stimulation of the vagus through the esophagus. He also observed some delay in emptying after excessive secretion. No distinct alteration in hydrogen ion content was noticed. Lim, Ivy and McCarthy[37] consider gastric secretion the resultant of three chief factors, namely: (1) Cephalic (rejecting Pawlow's word "psychic" because it has been found to be present in the absence of the cortex). This is induced by the taste, smell, sight and mastication of palatable food. Suggestion of such foods (hypnosis) also produces it (Luckhardt and Johnston[38]). (2) Gastric. This may be induced by mechanical

37. Lim, R. K. S.; Ivy, A. C., and McCarthy, J. E.: Quart. J. Exper. Physiol. **15**:1, 1925.

38. Luckhardt, A. B., and Johnston, R. L.: Am. J. Physiol. **70**:174, 1924.

distention in the presence of the intact vagus or without. Raw meat juice and histamine, when applied to the gastric mucosa in quantities insufficient to cause distention, excite gastric secretion. (3) Intestinal. This results from stimulation of chemical substances acting on the intestine. A meal passed directly into the intestine through an esophagoduodenal anastomosis causes secretion after some delay in the pouch made of the entire stomach. Mechanical stimulation of the intestine causes no such secretion.

These authors conclude that all stimulations exciting gastric secretion act essentially by increasing the active flow of blood through the gastric glands.

By transplanting a stomach into the mammary gland of a dog, Ivy[39] has succeeded in inducing secretion within from two to six hours after an ingested meal. He cites this as a demonstration of the fact that there is also a humoral transmission of stimulating substances.

From the maze of physiologic data that has accumulated, there are a few potent features that must dominate our conceptions and that are significant in connection with this thesis. It must be remembered con-

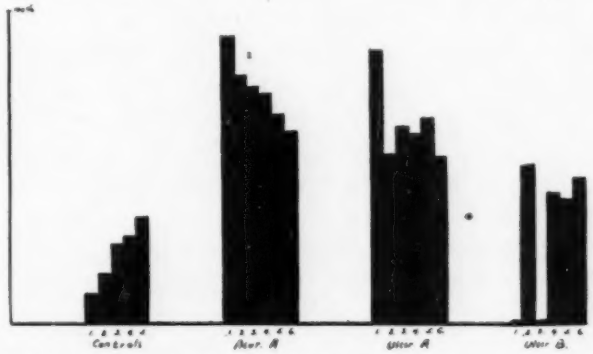

Fig. 1.—Schematic representation of the degree of autonomic imbalance in experimental groups: 1, cardiovascular reactions; 2, autonomic symptoms; 3, roentgen ray; 4, autonomic signs; 5, anxiety state; 6, hyperacidity.

stantly that the stomach has a large latitude of independence in all functions. On the other hand, like the heart, it responds to a tremendous number of afferent influences and is a delicate indicator of the general physiologic status. It is made to act in harmony with the rest of the organism through its connection with the central nervous system by the vagus and sympathetic nerves and through the action of various humoral substances on these nerve endings or on the muscle and gland tissue directly. The vagus nerve is essentially the motor or tonic nerve of the gastroduodenal system and the sympathetic is essentially the inhibitor. At the pylorus the latter has a rôle in the maintenance of tone and motility. Hence, these nerves together have a regulatory function. Many

39. Ivy and Farrell: Am. J. Physiol., **74**:639 (Nov.) 1925, Contributions to Physiology of Stomach, quoted from Ivy, A. C.: J. A. M. A. **85**:877 (Sept. 19) 1925; Physiology of Stomach, Arch. Int. Med. **25**:6 (Jan.) 1920.

forms of central and peripheral stimuli act through these paths on the gastroduodenal system, producing various forms of normal and abnormal functional responses.

PRODUCTION OF EXPERIMENTAL ULCERS

Gastroduodenal.—The three predominating conceptions concerning the origin of peptic ulcers are those set forth by von Bergmann,[40] Aschoff [24] and Rosenow.[41] Von Bergmann emphasized the coincidence of neurogenic disturbances and ulcer of the stomach. He was among the first to stress the fact that the two are corollaries and not opposites. He indicated the fallacy of attempting a sharp differentiation between neuroses and ulcers. Evidences of neurotic stigmas were found in 90 per cent of his cases of ulcer. He made no attempt to classify the abnormalities according to a definite branch of the autonomic system. Westphal and Katsch [42] agree with von Bergmann.

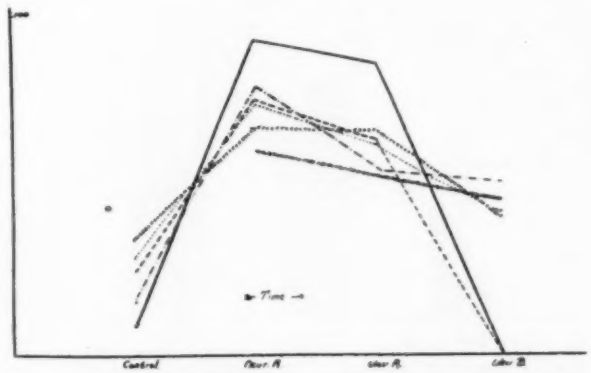

Fig. 2.—Schematic representation of theoretical chronological association between experimental groups. Solid line, cardiovascular reaction; dot and dash line, autonomic symptoms; dotted line, autonomic signs; dash line, roentgen ray; *x* line, anxiety state; etched line, hyperacidity.

Constitutional defects have been said to predominate in persons having ulcers. Nicotine, lead, tuberculosis and syphilis are the toxins most commonly mentioned as the bases for toxic degeneration of nerves in these so-called neurogenic theories of ulcer formation. Lehmann found, by pharmacologic methods, that only 20 per cent of cases of ulcer presented the stigmas mentioned by von Bergmann, and that other diseases also showed them; thus, he believed that there was no definite association with peptic ulcers. However, such workers as von Tabora, Bier, Thies, von Amstel, Gundelfinger, Haudek, Michaud, Adler, G. B. Gruber, Petrén and Thorling, von Redwitz, Grödel, Graul, Stierlin, Sauerbach, Bircher, Braun,

40. Von Bergmann, G.: Berl. klin. Wchnschr. **50**:2374, 1913; **55**:524, 1918.

41. Rosenow, E. C.: Collected Papers of the Mayo Clinic, 1917.

42. Westphal, K., and Katsch, G.: Mitt. a. d. Grenzgeb. d. Med. u. Chir. **26**: 391, 1913.

Keppich, G. Kaufmann, Steinthal, Schmieden, Nieden, H. Wheelon and Thomas, Könnecki, E. Nordmann, and others noticed the relationship pointed out by von Bergmann and agreed with him in his observations.

Acute.—The methods of producing acute lesions in the stomach are numerous. Rosenow and, more recently, Bohan and Haden,[43] using rabbits, have found ulcers in 7 per cent of 535 controls. Eleven rabbits injected with cultures of a given strain of streptococci developed lesions in the duodenum. The injection of pyridine, bacterial toxin and mineral poisons have produced lesions. Severe burns,[44] emboli and ligation of the portal veins have been mentioned in the literature.

Durante,[45] by extirpation of various parts of the splanchnic nerves, has produced ulcers and erosions in the mucous membrane of the stomach.

Finzi [46] found diseased suprarenal glands in five necropsies in patients dying from peptic ulcer. Barker [47] has reviewed the literature on the endocrine relation to gastric disturbance. It has been noted by Gibelli and Finzi [48] that animals dying after the removal of both suprarenal glands showed ulceration of the gastric mucosa in a number of cases. Carlson and Jacobson [48] found gastric and intestinal lesions in 75 per cent of thyroidectomized dogs. Friedman,[49] by injections of desiccated thyroid, produced gastric erosion in animals. Whether the autonomic acts directly in such cases or through the agency of the endocrine glands, or vice versa, is, of course, uncertain.

The removal of the suprarenal glands (Mann [50]) has produced ulcers. The gastro-intestinal symptoms in Addison's disease [51] have been thought to be evidence of epinephrine deficiency. Rassers [52] fed dogs on a salt-free and vitamin-free diet. He then fed them an acid meal and produced ulceration. Control dogs on a similar diet, without acid, showed no lesions. He concluded that deficiency in the diet made the mucous membrane of the stomach lose its resistance to the action of the acid.

As early as 1828, Cammerer, recognizing that neurogenic disturbances were potent in gastro-intestinal disorders, studied the effect of

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43. Bohan, P. T., and Haden, R. L.: Focal Infection in Peptic Ulcer, J. A. M. A. **84**:409 (Feb. 7) 1925.

44. Novak, E.: Am. J. M. Sc. **169**:119, 1925.

45. Durante, L.: Surg. Gynec. Obst. **22**:399, 1916.

46. Quoted by Friedman, G. A.: Arch. Diagnosis **10**:8, 1917.

47. Barker, L. F.: Endocrine Functions and the Digestive Apparatus, read at the meeting of the American Gastro-Enterological Association, May 7, 1918.

48. Quoted by Barker (footnote 47).

49. Friedman, G. A.: Arch. Diagnosis **10**:8, 1917.

50. Mann, F. C.: J. Exper. Med. **23**:203, 1916.

51. Rowntree, L. G.: Studies in Addison's Disease, J. A. M. A. **84**:327 (Jan.) 1925.

52. Rassers, J. R. F.: Klin. Wchnschr. **4**:644, 1925; abstracted in J. A. M. A. **84**:1704 (May 30) 1925.

cutting the vagus and branches of the sympathetic nerves. Jager, Lenhesek and Rokitansky all recognized relations between the stomach and nerve dysfunctions. Schiff and Ebstein, by intracranial experimentation, succeeded in altering the mucous membrane of the stomach. In more recent years, this type of work has been vigorously explored by the German school of investigators headed by G. von Bergmann.[40]

For a complete review of the literature on neurogenic disturbances in relation to diseases of the stomach, the paper of Stahnke (footnote 28) is recommended.

Hemorrhages, erosions and ulcers were observed after vagotomy by Günzburg, Saitta, van Yzeren, Zironi, Dalla Vedova, Lorenzi, Ophüls, Marchetti, Kobayashi, Lichtenbeldt, Kawamura, Crescimone and Anglesio, Antonini, Latzel, Nikolaysen and Keppich. On the other hand, no such alterations were noticed by other workers who have performed the same experiments. Among these were Körte, Krehl, Katschowski, Donati, Rubaschow, Kawamura (on dogs), Licini, Gundelfinger and Könnecke. The negative observations increase still further in number when one considers the large number of vagotomies that are performed in connection with other experiments. No such positive observations have been reported universally. These early conclusions may have been invalidated still further because of the multiplicity of factors that may play a rôle (such as anemia, shock, etc.).

Through disturbances such as splanchnic transections similar pathologic changes in the stomach have been noted. Such positive observations have been reported by Pinkus, Lewin and Boer, Popielski, Dalla Vedova, Bürger and Chruckmann, Kobayashi, Kawamura (on rabbits), Nagamori, Schmincke and Gundelfinger. The negative observations have been reported by Günzburg, Körte, Bonome, Frabusti, Carazzoni, Gibelli and Lilla, Donati, Lizini, Kawamura (on dogs), Stierlin and Enderlen.

Electric stimulation of the vagus was tried by Körte, Talma, Lichtenbeldt and Keppich on rabbits. Talma exposed the left vagus and, on weak stimulation, produced no change. Strong stimulation for six hours, however, resulted in hemorrhages and erosions in the pyloric region. This was thought by him to be due to stasis of blood from contraction of muscle. Körte and Donati apparently were not successful in obtaining a similar result. Lichtenbeldt came to Talma's conclusions. He placed animals in a water bath, transected the stomach at the esophagocardiac junction, and stimulated the peripheral portion through the vagus. Direct stimulation of the wall of the stomach resulted in ulceration. He concluded that ulceration resulted from direct stimulation and the ischemia due to contraction of muscle resulting from such stimulation. In this work, the stomach was laid open so that the observations could be made during experimentation. Keppich, desiring to obtain results more nearly simulating physiologic conditions, put a small wire in the upper part of the cardia about the vagus nerves, leading them out through the back. He, too, succeeded in producing hemorrhages and erosions in the stomach. Histologic section of the nerves so treated showed no degeneration. The obvious criticism of such studies, especially the two latter, is that changes produced by such unphysiologic methods are unsatisfactory. Timme[53] noted tissue alterations after vagus section, the result, he thought, of thoracolumbar overactivity. Stahnke, in by far the best experimental procedure, produced mucosal erosions after prolonged and excessive stimulation of the vagus.

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53. Timme, W.: J. Nerv. & Ment. Dis. **40**:311, 1913.

Mogilnitsky [54] examined the sympathetic ganglia and vagus nerves of several patients who died with gastroduodenal ulcerations. He reports having found degenerative and atrophic changes in the ganglia (sympathetic) and in the ganglion nodosum of the vagus. Degenerative changes were noted in Meissner's and Auerbach's plexuses. There was reduction in the cells in the sympathetic centers in the spinal cord, medulla and midbrain, but no changes were observed in the pallidum. He produced lesions in the region of the midbrain, in the area of the tuber cinereum, Luys' bodies, and the paraventricular and supra-optic nuclei in fourteen dogs. Eight dogs survived, and several of these later showed typical peptic ulcerations and erosions.

Westphal, Friedman, Nicolaysen and others used pilocarpine to obviate the error made by earlier workers. They also succeeded in producing ulcerations in the stomach of rabbits. Murata and Hashimoto believed that such results were due to spasm of the muscles rather than to spasm of the vessels, as had been maintained by the early workers. Haeller, on the other hand, thought this to be evidence of toxicity (pilocarpine). The changes in the mucous membrane were merely evidence of generalized poisoning. He asserted that the changes took place just before the death of the animal and when spasm was not present. To substantiate his contention, he produced spasm and increased peristalsis in rabbits without producing lesions. With large doses of morphine, physostigmine and atropine, he was able to produce the same lesions in the stomach. He concluded that, since physiologic antagonists such as atropine and pilocarpine could produce lesions, this must be the result of lowered resistance of the mucous membrane with self digestion. He even produced such changes by intoxication with carbon dioxide. Tashio Hayashi, using white rats, produced lesions in the fundus and the greater curvature by the use of muscarine and picrotoxin. He disagreed with Haeller.

The conflicting evidence in this literature is noteworthy. Much of the experimental data is useless. Experiments performed under unnatural conditions with many uncontrolled factors are of doubtful significance It may be said with some certainty, however, that mucosal erosions and ulceration of the stomach, not unlike those seen in the human stomach, may be produced in animals by alteration of innervation.

FACTORS IN CHRONICITY

Mann,[55] by connecting a jejunum to the stomach, demonstrated some of the time factors in the production of chronic ulcers. He found that: (1) ulcers may develop within one month after this operation; (2) the minimum time required to penetrate through a mucous membrane is from a few hours to twenty-four hours; (3) the time required to perforate through into the abdominal cavity might be anywhere from forty-eight to sixty hours; (4) the ulcer may present its typical appearance of chronicity any time after three weeks following its incipiency; (5) an ulcer five months old presents the same appearance as one a month old.

In Mann's opinion, the causes of chronicity are: (*a*) the presence of gastric contents (healing taking place more rapidly in the absence of the contents); (*b*) infection; (*c*) the fact that newly formed tissues are easily injured by mechanical insult, e. g., even by gently washing them with tap water.

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54. Mogilnitsky, B. N.: Virchows Arch. f. path. Anat. **257**:108 (July 3), 1925, quoted from Practical Med. Series **8**:255, 1925.

55. Mann, F. C.: Surg. Clin. N. Amer. **5**:753 (June) 1925.

Crohn, Weiskopf and Aschner[56] came to similar conclusions about the time factors in chronicity. Ulcers apparently may attain the maximum size within three weeks and do not extend their borders after this. Ulcers with hemorrhage seem to heal most readily.

Thus, although there is a stage in the existence of acute and chronic ulcers in which they necessarily overlap in symptomatology, the late ulcer is a separate and distinct clinical entity from the early one.

CONCLUSIONS

1. The gastroduodenal system is doubly innervated. It is chiefly dependent on the vagus as a regulator of tone and peristalsis. The pylorus is also dependent on the thoracolumbar control. The tone and peristalsis of the gastroduodenal system is thus influenced by central or peripheral stimulation.

2. The gastroduodenal system is so constituted that certain areas, by virtue of the richness or sparseness of mucosal folds (regardless of whether there is mechanical irritation of the surface due to the passage of food content) and because of the peculiarities of blood supply, are especially liable to be the sites at which mucosal erosion may be converted to chronic ulceration.

3. The problem of ulceration is pathogenically different from that of acute mucosal erosion or hemorrhage. Mucosal erosion may occur repeatedly and disappear quickly. Only a few lesions remain to become chronic, and these are largely dependent on the anatomic peculiarities of the site involved for their chronicity.

4. Mucosal erosions may be produced in many ways. Probably few of them are potent causes in the production of erosions in man. Disturbances in innervation, however, have been demonstrated to be the cause of mucosal erosions and these probably are of special significance in man.

ORIGINAL EXPERIMENTAL STUDIES

Using the method previously established for the determination of autonomic imbalance, we studied a series of patients with gastroduodenal syndromes. One hundred and nine cases of so-called "gastric neuroses" and 100 cases of gastroduodenal ulcers were studied and compared in order to determine, if possible, any criteria for differentiating between them. The histories in these groups were remarkably similar. It was only when the chronicity of the lesion in the gastroduodenal system had led to degenerative changes involving the loss of blood, scarring or adhesion, that real differentiation could be made. Roentgenograms taken after such changes were, of course, typical. From this it was concluded that

56. Crohn, B. B.; Weiskopf, S., and Aschner, P. W.: Life Cycle of Peptic Ulcer, Arch. Int. Med. **35**:405 (April) 1925.

no sign or test could be applied during the development of an ulcer that would establish the time when a neurosis ceased to be a neurosis and become a mucosal lesion.

To obtain, if possible, more direct evidence about these disorders, the methods previously applied to determine the autonomic status in normal persons were used. One hundred and eighteen cases showing gastroduodenal syndromes were studied, in addition to the forty-eight controls previously described. These cases were divided as follows:

1. Controls. These already have been described (forty-eight cases).

2. Ulcers. Thirty-two of these were proved at operation. This group is divided into two parts on the basis of history, physical observations, pharmacodynamic reactions and roentgenographic evidence:

Ulcers *A*—cases showing marked evidence of autonomic imbalance.

Ulcers *B*—cases showing less evidence of autonomic imbalance.

3. Gastric Neuroses *A* (twenty-eight cases). This group contained cases with a history not unlike ulcers but without satisfactory objective evidence, such as blood in the stool or vomitus, roentgen-ray or operative evidence, etc. These cases were thought, from the history and subsequent course, to be either acute ulcers or gastric neuroses.

4. Gastric Neuroses *B* (seventeen cases). This group contained cases presenting many evidences of autonomic imbalance but a cardiovascular reaction opposite to that observed in acute ulcers. Examples are seen in exophthalmic goiter and unclassifiable neuroses.

It is clear that the "neuroses" include many syndromes, embracing a few of which something is known and a larger number of which little is known. Among the former, presenting many marks of autonomic imbalance, is hyperthyroidism. The group of which less is known includes the large class that, for lack of a better term, are known as "neurotic." This loosely defined group of patients, which is continually being subdivided and classified, has, as far as the present knowledge is concerned, one thing in common; namely, subjective or objective disorders of autonomic function. The organ or group of organs chiefly involved in any particular case determines the present classification, such as cardiac neuroses, bladder neuroses, skin neuroses, intestinal neuroses, gastric neuroses, etc. In none of these, as previously mentioned, is the particular organ or system isolated in its derangement, but there is always, to a greater or less extent, an associated disturbance in function in the other organs supplying and receiving impulses from the interoceptive system.

We took from this group a number of cases that we defined as "neuroses *A*" which showed, in addition to the gastroduodenal dysfunction, characteristic associated changes mentioned in the definition.

For lack of information and because of our present special interests, we grouped all others into "neuroses *B*." They presented fully as many evidences of imbalance as the "*A*" group, but the imbalance was less clearly referable to the gastroduodenal system, and in other systems (e. g., cardiovascular) reactions, often of an opposite type were seen. They are as interesting and important as the "neuroses *A*" and possibly may represent still another phase in the evolution

TABLE 8.—*Results of Study of Autonomic Signs and Symptoms*

I. Percentage of Gastric Symptoms

	Controls	Neuroses *A*	Ulcers *A*	Ulcers *B*
Pain	30	60	96	82
Gas	35	75	90	82
Distress	35	61	75	90
Burning	15	40	65	27
Vomiting	18	28	70	90
	26	53	79	74

II. Percentage of Symptoms of Autonomic Imbalance *

	Controls	Neuroses *A*	Ulcers *A*	Ulcers *B*
Constipation	35	85	67	55
Diarrhea	18	52	40	17
Mucous colitis	5	52	30	36
Flushing	5	78	40	27
Palpitation	20	58	50	63
Cold extremities	27	94	75	63
Cyanosed extremities	27	100	75	73
Dyspnea	15	61	50	18
Pollakiuria	5	33	25	18
Urticaria	3	12	5	18
	16	55	46	39

III. Percentage of Signs of Autonomic Imbalance *

	Controls	Neuroses *A*	Ulcers *A*	Ulcers *B*
Epiphora	5	67	35	27
Hyperhidrosis	20	26	52	54
Pallor	27	48	35	27
Aschner's sign	18	50	40	9
Sinus arrhythmia	30	60	73	73
Cold extremities	27	96	75	63
Cyanosed extremities	27	100	75	73
Moist mouth	15	48	50	45
Habitus (asthenic)	23	90	50	45
Tremor	25	24	22	18
	21	53	51	36

* This list includes the more important observations; many other vegetative signs were investigated with unimportant results.

TABLE 9.—*Summary of More Significant Autonomic Observations*

Percentage of Symptoms

	Controls	Neuroses *A*	Ulcers *A*	Ulcers *B*
Mucous colitis	5	52	30	36
Flushing	5	80	40	27
Palpitation	20	58	50	63
Cold extremities	27	96	75	63
Cyanosed extremities	27	100	75	73
	16	78	54	52

Percentage of Signs

	Controls	Neuroses *A*	Ulcers *A*	Ulcers *B*
Epiphora	5	67	35	27
Hyperhidrosis	20	53	52	54
Sinus arrhythmia	30	60	73	73
Cold extremities	27	100	75	63
Cyanosed extremities	27	100	75	73
Moist mouth	15	46	50	40
	21	74	60	55

or progression of a neurosis. Members of the "neuroses *B*" class could not be ruled out positively as having potential ulcers, but there was nothing at the time of examination to make this seem probable. The vague gastroduodenal symptoms in hyperthyroidism were relieved following thyroidectomy or when the basal metabolic rate returned to normal. What further changes might take place subsequently we are not prepared to say.

TABLE 10.—*Percentage of Signs and Symptoms Following Injection of Epinephrine Hydrochloride*

	Controls	Neuroses *A*	Ulcers *A*	Ulcers *B*
Palpation	90	57	67	100
Feeling of anxiety	35	0	13	27
Tremor	95	71	65	100
Diaphoresis	17	0	0	18
Pallor	63	14	9	91
	60	28	31	67

TABLE 11.—*Cardiovascular Reactions after the Subcutaneous Injection of Epinephrine Hydrochloride*

	Controls	Neuroses *A*	Ulcers *A*	Ulcers *B*
I.—Percentage of cases showing a rise in systolic blood pressure of 15 mm. of mercury or over	92	15	8	100
II.—Percentage of cases showing the greatest rise in systolic blood pressure within thirty minutes after injection	81	81	72	92
III.—Percentage of cases showing a 10 per cent rise in systolic blood pressure lasting thirty minutes or longer	54	0	8	82
IV.—Percentage of cases showing a fall in diastolic blood pressure of 10 mm. or more of mercury	82	56	85	63
V.—Percentage of cases showing a rise in pulse rate of 10 or more beats a minute	75	77	80	82
VI.—Percentage of cases showing a 10 per cent rise in pulse rate lasting thirty minutes or longer	53	51	48	71

It was thus with the greatest difficulty that we confined our efforts to a specific type of the neuroses, with the hope that later we might explore the larger field further.

5. Other Types (forty-one cases). This group includes patients with gastroduodenal syndromes known to have such disorders as myxedema, pituitary dysfunction, intestinal new growth and Addison's disease.

For the purpose of discussion, groups 4 and 5 have been waived in the following statistical study.

STUDY OF AUTONOMIC SYMPTOMS AND SIGNS

The results of a study of autonomic signs and symptoms in the patients in the groups described above are given in tables 8, 9 and 10.

From the data presented in tables 8, 9 and 10, it is seen that:

1. The evidence of vegetative disturbance is most marked in neuroses *A*, somewhat less in ulcers *A*, still less in ulcers *B*, and least in controls.

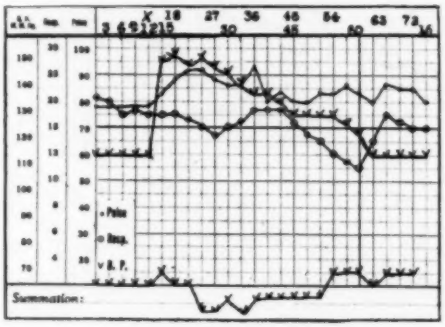

Fig. 3.—Reaction of normal subject given an injected dose of 14 minims (0.243 minims per kilogram of body weight) of epinephrine hydrochloride. The prompt and maintained rise in systolic blood pressure and pulse rate with the fall in diastolic pressure is typical. In this and figures 4, 5 and 6, *x* marks the time the injection was made, and the numbers at the top of the chart indicate minutes.

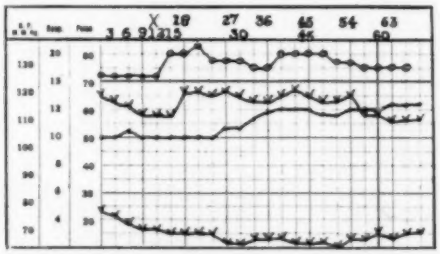

Fig. 4.—Reaction and signs of autonomic imbalance in a patient in neurosis *A* class. He received an injection of 14 minims of epinephrine hydrochloride. The small rise in systolic blood pressure and pulse rate is characteristic of this group.

2. The more marked autonomic changes observed in order of severity are: (*a*) those directly associated with the gastro-intestinal tract; (*b*) those associated with circulation, e. g., cold hands and feet, cyanosis, flushing, palpitation, Aschner's sign and sinus arrhythmia; (*c*) those associated with the skin, such as hyperhidrosis, dermatographia and cyanosis; (*d*) those associated with the eyes, such as epiphora and enophthalmos; (*e*) those associated with the mouth, such as moist mouth.

STUDY OF CARDIOVASCULAR REACTIONS

Cardiovascular studies were made according to the methods already described. Characteristic curves are shown in figures 3, 4, 5 and 6.

The more important observations, according to the analysis given in the illustrations, are seen in table 11.

COMMENTS

The rise in systolic blood pressure after the injection of epinephrine hydrochloride was moderate in most controls and in ulcers *B*. There was only a slight rise of systolic pressure in ulcers *A* and neuroses *A*. Three fourths of all the cases, after the injection of epinephrine hydrochloride showed a drop of 10 mm. or more of mercury in diastolic blood pressure. The duration of the rise in systolic blood pressure was much more marked in the controls and in ulcers *B* than in ulcers *A* or neuroses *A*. More than three fourths of all the rises in systolic blood pressure took place within the first half hour. The pulse rise was more marked in the controls and in ulcers *B* than in ulcers *A* or neuroses *A*. The duration of rise also was greater.

A satisfactory explanation of this cardiovascular reaction does not exist. According to the vagotonic concept, failure to react to epinephrine represents a lowered tone of the thoracolumbar system or parasympathetic predominance. An exact explanation of this is impossible until there is better understanding of blood vessel innervation. However, when the cardiovascular reaction of the controls is compared with that of the gastric neuroses and ulcers *A* groups, the difference is evident. Since the vasomotor tone is dependent on automatic status, it is safe to assume that reduced reaction to epinephrine is evidence of autonomic imbalance. Such imbalance was found to exist in a large percentage of cases in the ulcers *A* and neuroses *A* groups.

STUDY OF ROENTGENOGRAMS OF STOMACH IN GASTRIC NEUROSES AND ULCERS

The roentgen ray has demonstrated its superiority over surgical exposure in the study of gastric function. Variation in tone, peristalsis, evacuation and position can be determined only in this way. Small pathologic changes on the inside of the stomach wall, such as fissures and penetrating ulcers without surrounding scarring, also are discovered more easily by means of opaque meals and roentgenograms than by palpation and inspection of the outside of the stomach.

Stimulation of the vagus nerve in dogs, as has been demonstrated by Stahnke and others, results in markedly increased tone, hyperperistalsis, increased evacuation and often incisures so deep as to result in two distinct shadows.

Albu,[57] in describing the stomach of patients suffering from gastric neuroses, observed alterations similar to those which Stahnke observed in dogs after vagus

57. Albu: Berl. klin. Wchnschr. **57**:3, 1920.

stimulation. In a large series of roentgen-ray studies of gastric neuroses, Albu observed that the stomach tended to be high and deviated to the right, showing marked peristalsis and increased tonicity. There was speeding up of the passage of food content so that the stomach was quickly evacuated. Waves of all sizes and depths followed one another at great speed. These were often so deep as to divide the stomach into two separate portions. Spasm was especially marked in the pyloric region. Albu also emphasizes the difficulty frequently found in distinguishing between certain neuroses and ulcers. Disturbances in motility, tone and evacuation are similar.

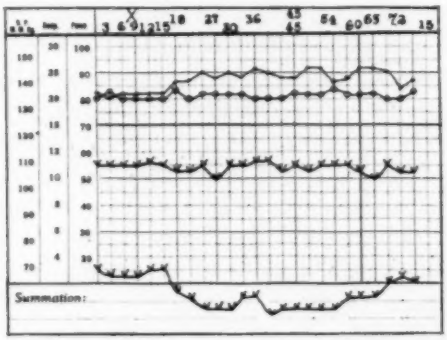

Fig. 5.—Reaction and signs of autonomic imbalance of patient with a brief history of ulcer (proved to be ulcer *A*). The failure of response after an injection of 14 minims of epinephrine hydrochloride is seen in the systolic blood pressure and pulse. No subjective symptoms were noted. The similarity to the curve in figure 4 is marked.

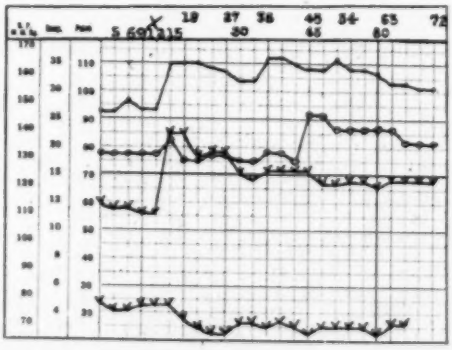

Fig. 6.—Reaction of patient giving a long history of ulcer. The evidences of autonomic imbalance were much less marked than in the curve shown in figure 5. This patient was included in the group of ulcers *B*. The response after the injection of 14 minims of epinephrine hydrochloride more nearly approaches that seen in figure 3.

In the present series, the roentgenographic observations were considered simply as further objective data of autonomic status. The cases were divided into the four groups already described: controls, gastric neuroses *A*, ulcers *A* and ulcers *B*. The opaque contents and outlines

were studied from the point of view of the position, peristalsis, evacuation, residue and tone of the gastroduodenal system. More or less arbitrary, although relative, standards of comparison were assumed in studying these qualities. The normal or control position was considered as "high" and "median," with relation to the fixed bony parts. With these as standards, it was noted that in the gastric neuroses *A* group, 58 per cent of the stomachs were in the median position and 90 per cent were high. In the ulcers *B* group, 75 per cent were in the median position and 62 per cent were high; 70 per cent of the stomachs deviated to the left and 100 per cent were high in the ulcers *A* class.

When 1 to 4 plus was used to indicate the degree of activity in considering peristalsis and minus to indicate the lack of peristaltic waves, the control group was found to have a plus-minus peristalsis in the cardia, 2 plus in the body, 2 plus in the antrum, and 2 plus in the duodenum. Of the gastric neuroses *A*, 93 per cent were found to have a minus or 1 plus degree of peristalsis in the cardia; 83 per cent, 1 or 2 plus in the body; 68 per cent, 3 or 4 plus in the antrum, and 87 per cent, 2 or 3 plus in the duodenum. The ulcers *B* group showed a minus or 1 plus degree of peristalsis in the cardia in 100 per cent of the cases, 74 per cent having a 1 or 2 plus in the body, 74 per cent a 2 or 3 plus in the antrum, and 63 per cent a 1 or 2 plus in the duodenum. The ulcers *A* group showed a minus or 1 plus degree of peristalsis in 85 per cent of the cases in the cardia; 71 per cent had a 2 or 3 plus in the body; 63 per cent a 2 or 3 plus in the antrum, and 65 per cent a 2 or 3 plus in the duodenum.

The speed of evacuation also was recorded by a plus-minus notation. In the controls, the speed of evacuation was considered as 2 plus. It was noted that 87 per cent of the gastric neuroses *A* group had a 2 or 3 plus speed. In the ulcers *B* group, the rate of emptying in 62 per cent of the cases was 1 or 2 plus, but 35 per cent of this group showed no immediate evacuation. In the ulcers *A* class it was noted that in all evacuation occurred almost immediately, 62 per cent of the stomachs emptying at about 1 or 2 plus rate and 30 per cent at a 3 plus speed.

Any opaque substance found in the stomach after six hours was considered a residue. None of the controls exhibited such a shadow; 94 per cent of the stomachs in the gastric neuroses *A* group emptied completely and 6 per cent presented a trace of residue. Of the ulcers *B* group, 62 per cent presented a residue varying from 5 to 100 per cent of the size of the initial opaque meal. In the ulcers *A* class, 86 per cent of the stomachs emptied completely and 14 per cent presented a trace of less than 5 per cent.

After a constant meal had been given, annotations on tone, based on the size and outline of the shadow, revealed that the controls were usually orthotonic. Of the gastric neuroses *A* group, 80 per cent were

found to be orthotonic or hypertonic, and 18 per cent hypotonic. The ulcers *B* group was found to be atonic or hypotonic in 50 per cent of the cases, orthotonic in 37 per cent and hypertonic in 3 per cent, whereas 84 per cent of the ulcers *A* group were found to be orthotonic or hypertonic and 16 per cent hypotonic.

From the data presented in table 12, it can be seen that the neuroses *A* group shows peristaltic activity greater than that of all other groups. This is closely simulated by the ulcers *A;* ulcers *B* show less deep waves, less activity and less tone. Evacuation is immediate in the neuroses *A* and ulcers *A* groups and less prompt in the controls; it is delayed to a greater or less extent in ulcers *B*. Tone is strikingly increased in neuroses *A* and slightly less in ulcers *A;* it is reduced in ulcers *B*. The stomach is higher in neuroses *A* and ulcers *A* than in ulcers *B*.

The functional derangements in the gastric neuroses *A* and ulcers *A* groups thus are shown to be closely correlated. Ulcers *B* tend to produce abnormalities of the opposite type, namely, atonicity and hypo-activity.

TABLE 12.—*Schematic Summary of Roentgenographic Observations* *

Position	Controls H.M.	Neuroses *A* H.M.—H.L.	Ulcers *A* 70% H.L.	Ulcers *B* Low M.
Peristalsis	+	+++	++	±
Evacuation	+	+++	++	—
Tone	+	+++	+++	—

* In the table, H. M.= high median; H. L.= high left, and Low M.= low median.

On the basis of roentgenographic observations, ulcers may be divided into two great classes. The first class often escapes notice on surgical exposure and may not be palpated; they tend to "ride" on the stomach wall, have little or no local scar reaction, and are apt to heal spontaneously in a short time, leaving little or no evidence of their presence. The second class includes cases showing large areas of ulceration, resulting in lamination, invagination and considerable cicatrization. Ulcers *A* of this series are comparable with the first class, and ulcers *B* with the second.

STUDY OF OTHER EVIDENCE

Graham and Guthrie [58] studied a series of 100 cases of functional (gastric) neuroses at the Mayo Clinic. On gastric analysis, they found the total acidity to be normal or below in 39 per cent of the cases; 61 per cent showed hyperacidity. These results may be compared with those obtained by the same authors in a study of 250 cases of ulcer. Free hydrochloric acid was found in 237 cases and was absent in thirteen. The total acidity in 53 per cent of the cases was normal or below normal, and 47 per cent showed hyperacidity. It is noted that the total

58. Graham, C., and Guthrie, D.: Collected Papers of the Mayo Clinic, 1905 and 1909.

acidity is greater in the neuroses than in the ulcers. To be sure, it is difficult to determine what Graham and Curtis included in their group of neuroses, but probably they would fall into the class that we have designated as neuroses *A*.

It is possible to infer from these observations that reduction in secretion is associated with chronicity and may roughly parallel reduction in tone and peristalsis that was observed in the ulcers *B* group of this series.

Friedman [59] believes that the autonomic status in gastric and duodenal ulcers is different. He noted a high blood sugar in patients having gastric ulcers and a low one in those having duodenal ulcers. He also found that there is a polyglobule (relative polycythemia) in duodenal ulcers that is not seen in gastric ulcers. In this series, the blood changes described by Friedman as typical of duodenal ulcers were noted in cases of the neuroses *A* and ulcers *A* groups.

In these groups, it was noted that the patients with the most striking evidences of autonomic imbalance had a characteristic emotional syndrome. They were usually hard-working and conscientious. They often seem harassed and apparently chronically fatigued, and the emotional habitus, like the physical, gave one the impression of asthenia. "Worry" was present in a high percentage of cases; persistent anxiety or apprehension frequently were present. In a fair number of cases precipitating psychic traumas could be related to the patient's entrance to the hospital. An illustrative case is seen in a woman, aged 60, who had had stomach trouble for twenty-eight years. She had visited her sister regularly for a week at the hospital in which the latter died. For four nights preceding the death, she remained with her dying sister. She lived irregularly, slept little, ate little and was much disturbed emotionally. Returning from the cemetery, she had a severe attack of hematemesis and was brought to the hospital. A large ulcer was found. Most patients cannot relate any emotional crisis to their pain, but usually give a story of long and exhaustive work and worry. Constant, persistent, irritating influences or psychic traumas, such as domestic strife, incompatibility with employer and fellow employees, lack of time for relaxation, intense business drives, long, trying cases (nurses and lawyers) have been mentioned repeatedly.

The patients in the ulcers *B* group showed less acute emotional disturbance. They frequently, however, gave a history of such disturbance in the past.

Kaufmann [60] cites one case in which the patient had had four gastroenterostomies performed for recurrent ulcers following as many emotional crises.

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59. Friedman, G. A.: J. M. Research **38**:449, 1918.
60. Kaufmann, C.: M. Rec. **94**:324, 1918.

Although it is possible that the "vagotonic" state described by Eppinger and Hess may exist in these cases, it was considered unwise, in view of our ignorance, to use this term. The words "autonomic imbalance" better convey the real state of affairs and do not present a philosophy. "Autonomic imbalance" indicates that there is or has been a longer or shorter period of dysfunction of the autonomic system, in which there may be especially marked evidence of local imbalance; that is, a given system may be abnormal, whereas others are not abnormal or are less so. Excessive activity of the vagus nerves in the gastro-intestinal system need not be proof of such excessive vagal action everywhere. By the imbalanced state one does not mean that the vagus is in excessive tone. It may, as a matter of fact, be in less tone than is usual and still be in excess of that of the thoracolumbar system, locally or in general. A control case may show much more evidence of vagal activity by the foregoing rough tests than another with evidence of vagal predominance, and still may show no symptoms. Whenever ignorance is as great as it is in these problems, it is safer and better to replace the prefixes "hypo" and "hyper" by "dys."

TABLE 13.—*Percentage Incidence of Anxiety State (Acute)* *

Controls	30
Neuroses *A*	68
Ulcers *A*	65
Ulcers *B*	40

* Acute means in this instance that the subject had at the time of examination an exacerbation of a mild "anxiety state," often similar in nature to attacks previously experienced.

The observations made in this study indicate that autonomic imbalance plays no small part in the pathogenesis of gastroduodenal ulcers. Von Bergmann and his school have emphasized the importance of autonomic imbalance in the causation of peptic ulcers. It is their belief that alterations in the innervation result in spasm. This supposedly gives rise to an anemia or congestion of the tissues accompanied by nutritional disturbances. The temporary alteration and devitalization are said to result in necrosis and erosion of the tissues. Whether such changes, as these authors indicate, actually take place is unknown and doubtful.

HYPOTHESIS

The following hypothesis is presented as an explanation of the accumulated data: Irritative impulses (either central or peripheral) may be conveyed by means of the vagus nerve and sometimes, though probably rarely, by the thoracolumbar branches to the gastroduodenal system. Central stimuli may be psychic, toxic, mechanical or infectious. Visceral

or peripheral stimuli may result from any visceral disease, acute or chronic, such as disease of the biliary tract, so-called chronic appendicitis, congenital bands, pyelitis or peripheral neuritis. Impulses arising from these visceral foci may be conveyed directly or indirectly to the hindbrain or, possibly, through the thoracolumbar fibers to the stomach. The high incidence of anxiety states in these patients suggests that emotional disturbances may be a significant central factor. Two possibilities are suggested: (1) psychic traumas may be one of the factors directly responsible for autonomic imbalance; (2) toxic foci elsewhere in the organism may be responsible for both altered psychic state and autonomic tone.

Animal experimental evidence shows that autonomic imbalance is capable of producing mucosal erosions and ulcerations. The mechanism of this production of ulcerations cannot be stated. It is unnecessary to assume the existence of spasm of the vessels or local ischemia, based on excessive muscle tone (von Bergmann et al.). Trophic lesions may occur from other causes. Hypothetically, neuroses *A* and ulcers *A* can thus be understood.

We would explain the ulcers *B* with their less striking autonomic imbalance as follows: The erosions, as explained above, are probably multiple. The majority heal spontaneously,[61] especially those occurring in the cardia or fundus. Those that happen to occur in the gastric pathway or cap are exposed to factors that may cause perpetuation. The initial irritative factor, whatever it may have been, may easily have disappeared. It is unnecessary to assume the perpetuation of the autonomic imbalance;[62] it is probably self-limiting and readjusts itself just as many of the endocrine dysfunctions do. The mucosal erosion may, however, continue with its pathologic changes and present symptoms due now to its own local action; consequently, the patient tested during this period would present the syndrome of the ulcer *B* group.

If this chronologic relationship is assumed, the association becomes clearer. A chronic gastroduodenal ulceration is one that has passed through the stages of gastric neurosis and ulcer *A* and ultimately becomes ulcer *B*.

How long the neurosis exists as such before it becomes an ulcer *A* is impossible to say. An acute ulcer may result after a few hours or possibly months of perverse innervation. To attain chronicity, or the ulcer *B* stage, certainly takes a longer time. Again, chronologically arranging our material, we may refer to a case as having passed through the stages of gastric neurosis, acute ulceration and on to spontaneous cure or chronic ulceration.

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61. Lehmann, H.: Mitt. a. d. Grenzgeb. d. Med. u. Chir. **39**:185, 1926.

62. Wolfer, J. A.: Chronic Experimental Ulcer of Stomach, J. A. M. A. **87**: 725 (Sept. 4) 1926.

The degree of autonomic imbalance is striking in gastric neuroses and acute ulcerations. It may be striking in some chronic ulcerations with acute exacerbations from whatever cause. In this case, a lesion that might differ little from an ulcer *B* in microscopic section might, on analysis, give evidence of autonomic imbalances such as is seen in ulcer *A*.

Thus, briefly stated, a group of patients with gastric syndromes have been demonstrated to have autonomic imbalance. A gastric neurosis may evolve into an acute ulcer. If, by force of circumstances, the ulcer becomes infected or is otherwise prevented from healing, chronic degeneration and attempts at repair may result. This may occur in spite of the fact that autonomic tone gradually has returned to normal. The chronic changes may continue until perforation or retention make the patient seek medical aid.

An obvious criticism of this concept should be considered. May not the evidence of autonomic imbalance follow the local disturbance in the stomach? May not the mucosal erosion or ulceration be another peripheral irritative influence directly or indirectly stimulating the vagus and so giving rise to the symptoms and signs that are here reported? This possibility, in our opinion, has been practically ruled out for the following reasons:

1. Many cases of autonomic imbalance have been studied in which the general and gastric symptomatology, although present, was secondary to and entirely inundated by symptoms and signs from organs supplied by other parts of the vegetative system. Such instances have been seen in patients in whom the presenting symptoms were ptyalorrhea, excessive sweating, mucous colitis and vascular hypotension. No local changes could be demonstrated as the causative agent.

2. Those cases showing the most marked deformity in gastroduodenal contour (ulcers *B*) often show little or no evidence of autonomic imbalance. If the autonomic imbalance were the result of peripheral stimulation from the ulcer, then it should be most marked in the chronic or ulcers *B* group.

THERAPEUTICS

Some surgeons, feeling that perverted innervation influences postoperative results, have recommended section of the nerves. Podkaminsky [64] recommends a prophylactic vagotomy after gastro-enterostomy. Schiassi,[65] by vagotomy and transverse section of the stomach near the pylorus and in order to eliminate the sympathetic nerves, claims to have secured more permanent cures after gastro-enterostomy. Devine [66]

64. Podkaminsky: Zentralbl. f. Chir. **52**:568, 1925.
65. Schiassi, B.: Ann. Surg. **81**:939, 1925.
66. Devine, H. B.: Surg. Gynec. Obst. **40**:1, 1925.

emphasizes the autonomic disturbances in ulcers and their significance in the surgical treatment, as also does Rost.

From the standpoint of therapeutics, this work emphasizes the need for greater consideration and therapeutic interest in the important gastric neuroses, because of the obvious distress they cause, their potentiality and the extreme difficulty in distinguishing them from early ulcerations. Correct therapy at this stage may prevent chronic ulceration.

Moreover, no special value was found in and no indications seen for the use of the so-called specific autonomic drugs. The use of the ordinary methods of physiologic and, especially, psychologic rest, with sedatives, diet and the other usual means were successful in the treatment of the neuroses and acute ulcers, whereas operative treatment remained the only solution for the chronic, highly cicatrized lesions.

Thus, briefly stated, the relationship of autonomic imbalance to gastroduodenal ulceration is apparently that of an important mechanism capable of producing significant intermediate changes in the tissues, similar in a manner to the altered blood sugar level in diabetes which results in coma and death. The prime factor behind it all still must be unearthed. For the present, we can consider only the mechanism and not the force.

CONCLUSIONS AND SUMMARY

1. In spite of the inadequacy of experimental methods for the study of autonomic disturbances in man, certain gross differentiations of clinical syndromes are possible.

2. Anatomic and physiologic peculiarities cause the gastric pathway and the first part of the duodenum to be especially favorable sites for chronic ulcerative processes, once an initial mucosal erosion or hemorrhage has occurred. There is much experimental and clinical evidence to indicate that the agents producing mucosal erosions and those perpetuating such erosions with the production of chronic lesions are separate and distinct and should not be confused. A study of the etiology of gastroduodenal ulcers must therefore consider the agents capable of producing erosion in the mucous membrane separately from those that perpetuate them. Failure in this respect has led to conflicting evidence and conclusions in the past.

3. A review of past experimental observations on the etiology of mucosal erosions shows many of them to be of little value. More recent experiments, performed by electrical stimulation of the vagus with the organs in situ and intact, are of great significance. Under such circumstances, excessive stimulation of the vagus has led to hypertonicity, hyperperistalsis, hypersecretion and mucosal erosions.

4. A group of so-called gastric neuroses has been found to have much evidence of autonomic imbalance, as compared with controls.

5. A group of acute gastroduodenal ulcers has, in a high percentage of cases, shown evidence of autonomic imbalance similar to that of the gastric neuroses. The close relationship of this group of ulcers to the neuroses is thus strongly suggested.

6. Another group of gastroduodenal ulcers has shown little or no evidence of autonomic imbalance. This group gave the usual evidence of chronicity and stenosis.

7. The fact that some advanced chronic ulcers are not associated with more marked autonomic changes indicates that the lesion in the stomach does not in itself give rise to the autonomic alterations. The fact that the most marked autonomic imbalance is found in those cases (gastric neuroses) in which no ulcer can be shown to exist, suggests that the altered autonomic tone may precede the lesion in the stomach.

8. An hypothesis is presented correlating these and other observations. It is possible that central (toxic, mechanical, infectious, psychic, etc.) or peripheral irritation (chronic appendicitis, disease of the biliary tract, congenital bands, genito-urinary diseases, etc.), by direct or indirect stimulation of the vagus, may cause a mucosal erosion. The altered autonomic balance may or may not continue, but the mucosal erosion, once produced, and the anatomic and physiologic pecularities at the site of the lesion will determine whether or not a chronic gastroduodenal ulcer will occur or whether immediate spontaneous healing will take place.

9. Emphasis is placed on the difficulty of differentiating between early or acute ulcers and certain gastric neuroses. Attention is directed to the presence of autonomic imbalance as an aid in the diagnosis of cases of early ulcer.

10. On the basis of this hypothesis and clinical experience, a few suggestions on therapy are made.

MECHANISM OF COMPRESSION IN A CASE OF TUMOR OF THE CEREBELLOPONTILE ANGLE

STUDIED BY SERIAL SECTIONS OF THE BRAIN *

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SAN FRANCISCO

Distortion of the pons, cerebellum and medulla by tumors of the cerebellopontile angle has been described by Cushing.[1] The pons becomes indented, the medulla pushed over, the cerebellar hemisphere dislocated and with increased growth of the tumor the hemisphere becomes a "nest" in which a large portion of the tumor lies.

Alexander and von Frankl-Hochwart [2] and Jumentié [3] have studied the brain stem histologically for degenerative changes. Whereas the former investigators found nothing definitely abnormal in serial sections stained by the Marchi method, the latter found definite lesions in the cerebellar nuclei, particularly in the dentate nucleus of the corresponding side. This lesion consisted of an atrophy of the interstitial matter of the nucleus and not of its cells and was explained by involvement of the middle cerebellar peduncle. In Jumentié's series, distortion and atrophy of fibers, erosions, small areas of degeneration and hemorrhage were found in this peduncle, and in one such case attacks of cerebellar crises occurred with jacksonian epilepsy in the corresponding arm.

REPORT OF CASE

A Swedish tailor, aged 58, complained of deafness, difficulty in walking, and impaired use of the right extremities. These symptoms had come on gradually during thirteen years. He did not complain of headache, dizziness, eye trouble or pain. There was no previous history of venereal disease, eye trouble, or any serious illness. A brother had died of carcinoma of the stomach.

The general physical examination did not reveal any cardiovascular renal or other systemic disease, and the usual laboratory tests, including a blood Wassermann test, were negative.

The neurologic examination, however, presented a striking picture of cerebellar incoordination affecting the station, gait and the use of the right extremities.

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* From the Neurological Laboratory, Stanford University Medical School.

* Read before the Fifty-Second Annual Meeting of the American Neurological Association, Atlantic City, N. J., June 1, 2 and 3, 1926.

1. Cushing, Harvey: Tumors of the Nervus Acusticus, Philadelphia, W. B. Saunders Co., 1917.

2. Alexander, G., and von Frankl-Hochwart, L.: Ein Fall von Akustikustumor, Arb. a. d. neurol. Inst. a. d. Wien. Univ. **11**:385, 1904.

3. Jumentié: Les tumeurs de l'angle ponto-cérébelleux (Étude anatomo-pathologique et clinique), Paris, Steinhill ed., 1911.

Fig. 1.—Right-sided acusticus tumor in situ.

Fig. 2.—Chromated cerebellum and brain stem (Meynert's section) with tumor removed.

To stand or to walk was impossible without support. Adiadokokinesis and asynergia were marked in the right upper extremity. Pathologic reflexes were not present, and somatic sensation was normal. Deafness was complete in the right ear and only a loud voice could be heard in the left. The right labyrinth was inactive, as evidenced by the absence of an induced nystagmus by the caloric test. The left labyrinth was active. A spontaneous nystagmus of horizontal type was constantly found on lateral movement of the eyes to the right. An inconstant paralysis of the abducens was present on the right, and the corneal reflex was diminished on this side. Facial paralysis was not present, nor were there any bulbar symptoms. The ocular fundi did not show any papillitis or neuritis, but surrounding both disks were retinal patches which suggested an old choroiditis.

The cerebrospinal fluid pressure was 110 mm. of fluid. The fluid was clear and contained an increase of globulin without an increase in cells. The Wassermann test of the spinal fluid was negative.

The patient was observed for three years and was repeatedly examined. The incoordination slowly progressed in severity. The clinical picture was typical of a tumor of the acusticus except for the absence of facial involvement, of symptoms of an obstructing internal hydrocephalus and of papilledema.

Toward the last, the patient developed a carcinoma of the tongue and died of a complicating pneumonia. A complete necropsy was performed by Dr. Bailey of the Pathological Department of the Stanford Medical School. The anatomic diagnoses were: fibrosarcoma of the brain, cerebellopontile angle; carcinoma of tongue; carcinoma of submaxillary and cervical glands (metastatic); bronchopneumonia.

The tumor of the acusticus showed bundles of spindle cells with connective tissue fibrils between them. The peripheral part of the tumor was fibrous. It is interesting to note that this patient had two different histogenetic tumors and that there was a familial history of cancer.

PATHOLOGIC STUDY

The brain, with the tumor in situ, was hardened in 10 per cent solution of formaldehyde. The brain stem and cerebellum were detached from the hemispheres by Meynert's section. With the tumor still in situ, the specimen was chromated; then the tumor was removed and a celloidin inclusion made. Serial sections were cut and stained by Kulschitzki's myelin stain, and in certain areas sections were counterstained by cochineal. Transverse sections were cut and numbered from the cephalic end of the specimen to the caudal end, so that the illustrations are viewed as from in front. The side to the left of the illustrations corresponds to the right side anatomically.

Only the upper cervical cord was available for study. Myelin degenerations could not be made out in this portion of the cord. Likewise, the medulla at the level of the pyramidal decussation did not show any abnormalities either internally or externally from pressure. Degeneration in Flechsig's or Gower's tract could not be made out at this level or in sections further cephalad.

A diminution in the size of the restiform body on the side of the tumor appeared at the middle of the inferior olive (fig. 3), and there

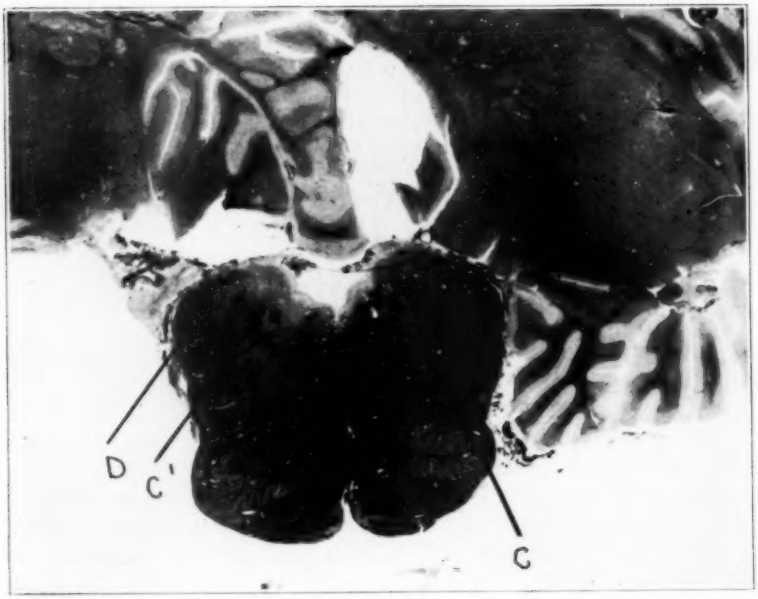

Fig. 3.—Section showing *C*, descending vestibular root, normal on left; *C*,' atrophied on right; *D*, atrophy of restiform body on right.

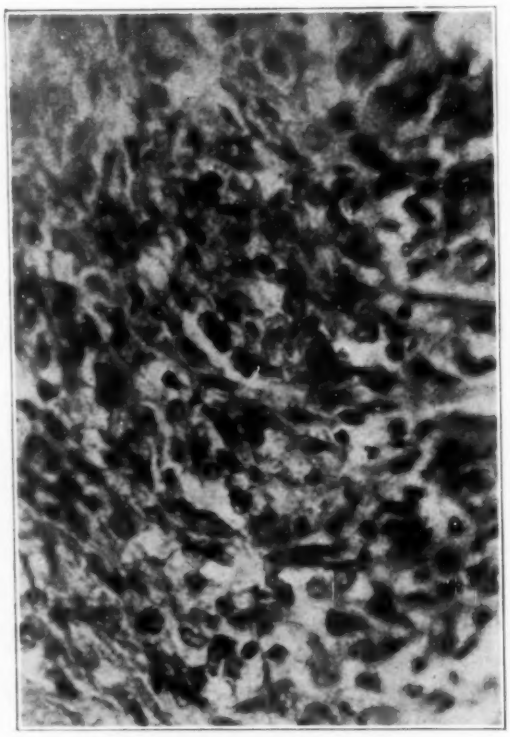

Fig.4.—Appearance of tumor. High power magnification. Hematoxylin eosin stain.

was also a marked decrease in the fibers of the descending vestibular root. At these levels the question of vestibular nuclear involvement arose, but no definite conclusions could be drawn from investigation of the nuclear aggregations themselves because the chrome fixation interfered with adequate nuclear stains. The large cells of Deiter's nucleus could be identified on the affected side, however, in abundance, and the triangular nucleus did not seem shrunken in its gross appearance. The position of the tumor and its relation to the brain stem and cerebellum were well shown (fig. 4). The brain stem itself was only slightly deformed, the compression taking an upward and outward

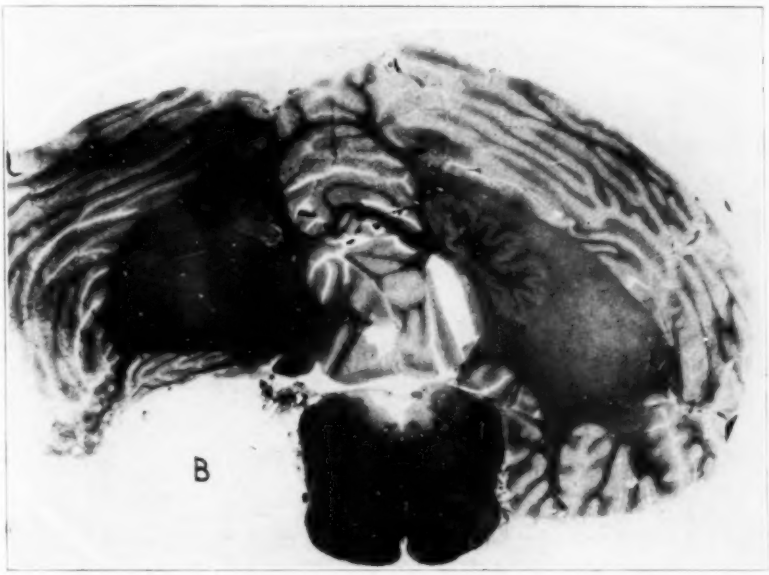

Fig. 5.—Section through medulla at the middle of the inferior olive. *B*, nest of the tumor.

direction, affecting the right cerebellar hemisphere and the middle peduncle. At sections through the dentate nuclei the nucleus on the tumor side was distinctly poorer in fibers but not, apparently, in cells. No trace of the eighth nerve appeared on the tumor side (fig. 5), whereas on the normal side its course was well marked. On the right side the cochlear nuclei were completely destroyed, not a trace of them remaining. The facial and abducens nerves were bilaterally represented and of apparently equal size. The superior peduncles appeared also to be of equal size.

The lower tegmentum showed a flattened and compressed aqueduct, which was still patent. At this point apparently there is danger of an obstructive internal hydrocephalus in tumors of the cerebellopontile

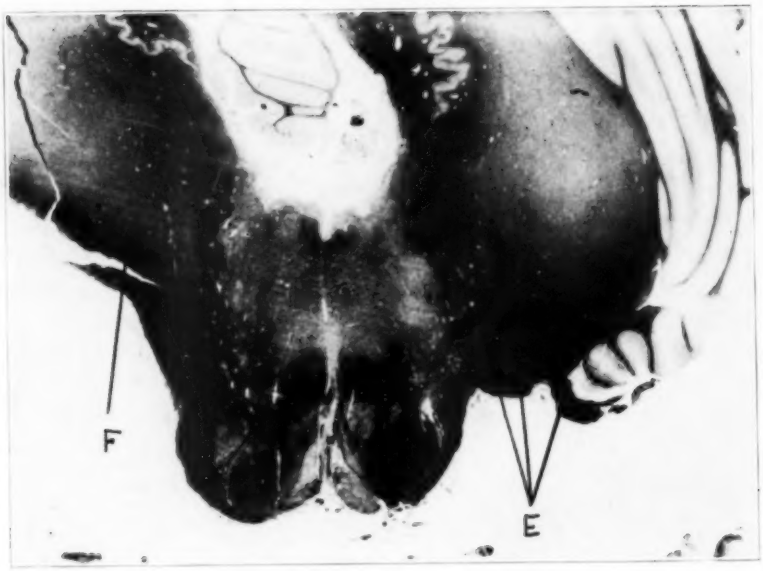

Fig. 6.—Level of entrance of eighth nerve. *E*, fibers of eighth nerve on left, missing on right; *F*, compressed and sclerosed middle cerebellar peduncle.

Fig. 7.—Flattened and compressed aqueduct, still patent.

angle. Further cephalad the aqueduct retains its regular shape. The lateral leminiscus appeared not to be relatively diminished on the affected side. The red nuclei appeared normal, and the structures in this region and above did not reveal any pathologic change with the staining methods employed. These cephalic sections were continued through the thalamus and lenticularis and internal capsule.

CONCLUSION

The case reported was of a typical tumor of the acusticus of slow growth which presented a marked cerebellar incoordination but lacked any indications of optic edema, symptoms of intracranial pressure, and facial paralysis. The choroidal changes about the disks may well have resulted from a former papillitis, due to transient fluid block. The compression of the brain stem was not marked, as the tumor extended upward and outward at the expense of the cerebellar hemisphere and the middle cerebellar peduncle. The lack of degeneration in the dentate nucleus, superior peduncle and red nucleus suggested that the cause of the cerebellar incoordination should be sought elsewhere. The evident cause was found in the degeneration of the middle peduncle and of the restiform body and in the degeneration of the descending vestibular root, both of the latter degenerations being dependent on the unilateral destruction of the vestibular nerve root.

THE INFANTILE TYPE OF FAMILY AMAUROTIC IDIOCY

REPORT OF TWO CASES *

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AND
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In a recently published monograph on the microscopic changes in the heredosystemic diseases, K. Schaffer again states with emphasis that family amaurotic idiocy is an ideal example of a systemic heredodegeneration.[1] It is well characterized as to ontogenetic origin and as to blastodermic, systemic and segmental localization. The blastodermic localization is shown by an elective degeneration of only ectodermal tissue, histologically represented by the swelling of the hyaloplasm, which at a later stage is replaced by granular precipitations. At the first stage, the prelipoid, the ganglion cells do not stain with fat stains, but in most of the cases they do stain with hematoxylin; at the second, the lipoid stage, which corresponds to the late infantile and juvenile cases, the granular precipitations within the ganglion cells can be stained with sudan and scarlet red. The process of swelling is distributed throughout the nervous system and reveals itself by extreme distortion of the cell bodies and localized swelling of the dendrons, which is later followed by less pronounced swelling of the axons. The degeneration of the glia is shown by the formation of monster glia cells or mastglia. The formation of scavenger (gitter) cells and of dense networks of glia fibers is a secondary process, the purpose of which is removal of waste products of degeneration and repair with formation of scar tissue.

The systemic degeneration is shown by the selective demyelinization of fiber systems and swelling of cell layers which are relatively young in phylogenetic and ontogenetic origin. The segmental localization is not so pronounced, but the process of swelling is rather generally distributed throughout the central nervous system. Only in some selected cases is the cerebellum specifically affected, as shown by sclerotic atrophy

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* From the Neuropathology Laboratory of Montefiore Hospital and the Pediatric Service of Lebanon Hospital.

* Read at the Fifty-Second Annual Meeting of the American Neurological Association, at Atlantic City, N. J., June, 1926.

1. Schaffer, K.: Ueber das morphologische Wesen und die Histopathologie der hereditäer systematischen Nervenkrankheiten, Berlin, J. Springer, 1926. This monograph contains the entire literature of amaurotic family idiocy up to 1925.

and hypoplasia as well as by Bielschowsky's centripetal type of degeneration of the cortical neurons. Hassin [2] has tried to demonstrate the preference for thalamic involvement in infantile cases.

The ectodermal selectivity in amaurotic idiocy is now a generally recognized fact. The combinations with pachymeningitis or leptomeningitis or with the rests of fetal encephalitis, which clinically produced the picture of so-called cerebral diplegia and are found sporadically in the literature, cannot be classified as heredofamilial types of amaurotic idocy.

Schaffer's theory of the nature of the endogenous process of swelling is not so generally accepted. His opinion, that the swelling of the neurons originates in swelling of the hyaloplasm, is opposed by Bielschowsky, Spielmeyer and others, who believe that the formation of granular degenerative deposits of a lipoid character produces the distortion of the cell bodies. Schaffer again emphasizes that most of the cases published by those authors were of the late infantile or juvenile type, in which the stage of swelling seen in infantile cases was already replaced by granular coagulation, staining with hematoxylin thus being impossible.

The following two cases represent clinically the classic picture of Tay-Sachs' disease, but in some points differ anatomically from the classic types.

REPORT OF CASES

Case 1.—E. S., a girl, aged 3, entered Lebanon Hospital with convulsions and died fourteen hours after admission. The obstetric history was without significance. The child had been breast-fed up to 8 months. At 6 months she had become blind, and at 1 year the parents had been told that the child had amaurotic idiocy. She sat up with difficulty at 2 years, but never walked. There was a marked hyperacusis.

Examination.—This revealed paralysis of both upper and lower extremities together with idiocy and blindness. The Wassermann reaction was negative.

Necropsy.—Postmortem examination of the brain showed widening of the fissures of Rolando and Sylvius. The consistency of the cerebrum was harder than normal; that of the cerebellum was normal. After fixation for three weeks in 10 per cent solution of formaldehyde the cerebrum began to soften; after one and one-half years it had not regained a normal consistency. The cerebellum was normal. There was neither atrophy of the brain nor changes in the meninges. The ventricles were not enlarged.

Microscopic Report.—By staining whole vertical sections of the cerebrum and cerebellum (Loyez' method), degeneration of the myelin sheath could not be detected; all fiber systems, including the pyramidal, were well developed. With Bielschowsky's stain no marked disfiguration of the axis cylinders could be detected, but only a mild degree of swelling. Throughout the whole cortical layers

2. Hassin, G. B.: A Study of the Histopathology of Amaurotic Family Idiocy (Infantile Type of Tay-Sachs) Arch. Neurol. & Psychiat. **12**:640 (Dec.) 1924.

Fig. 1 (case 1).—Swelling of ganglion cell and isolated swelling of the main process. Bielschowsky stain; Zeiss ap. 2 mm.; comp. ocul. × 10.

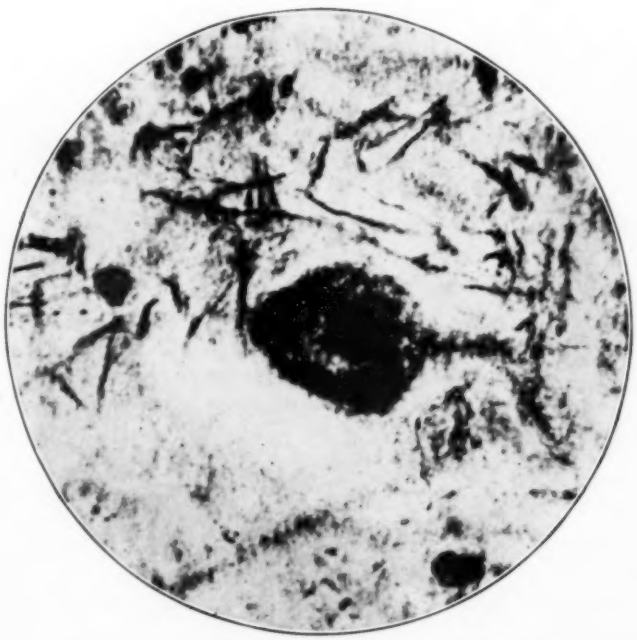

Fig. 2 (case 2).—Swelling of ganglion cell. Bielschowsky stain; Zeiss ap. 2 mm.; comp. ocul. × 10.

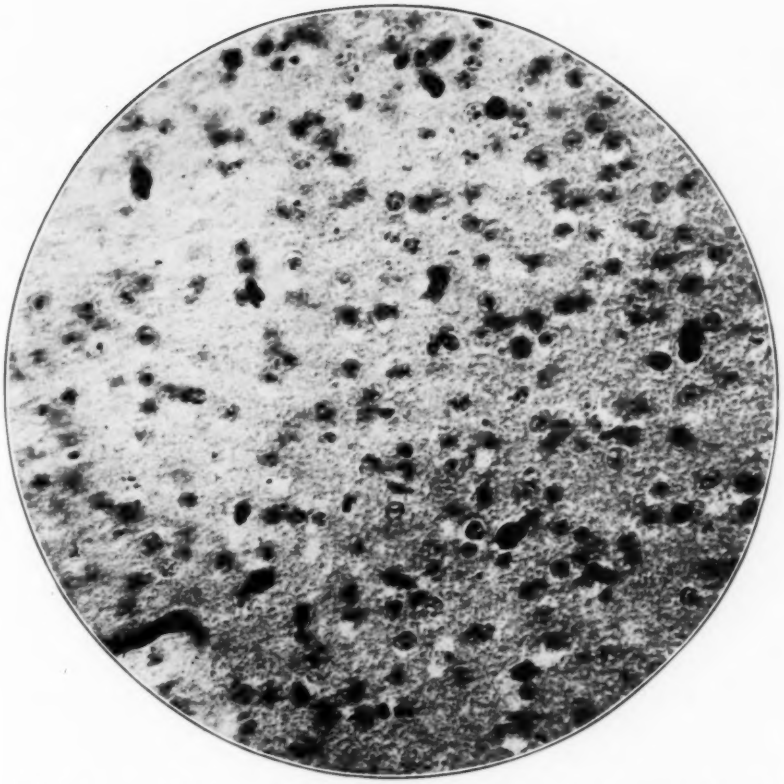

Fig. 3 (case 1).—Increase of glia cells with coarse granular staining in Loyez' stain; frontal lobe. Zeiss 16 mm. ap.; comp. ocul. × 7.

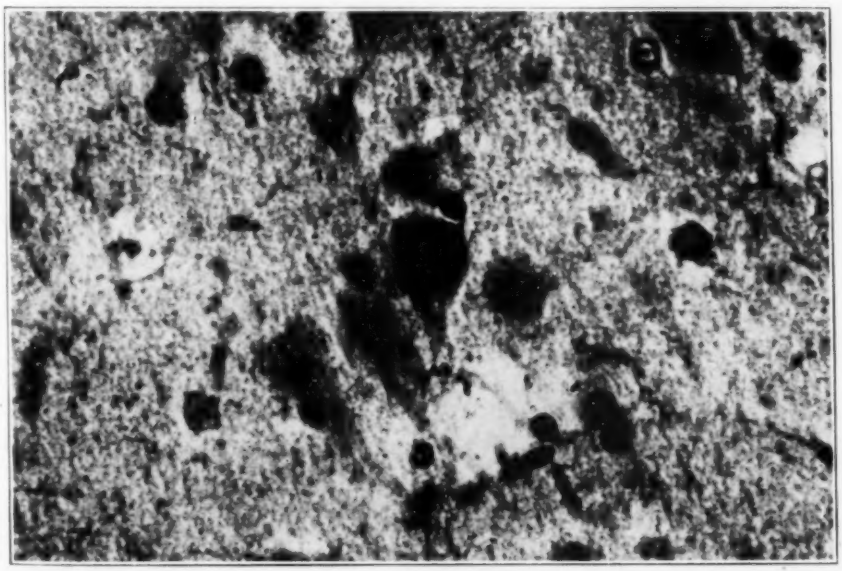

Fig. 4 (case 1).—Fine, dust like staining of ganglion cells and coarse granular staining of glia cells in Loyez' stain. Zeiss 4 mm. ap.; comp. ocul. × 10.

was found a decided swelling of the ganglion cells; most of them had lost their normal outlines; they were rounded and the nucleus was dislocated. With toluidin blue stains the chromatin substance was accumulated around the nucleus and had lost its characteristic configuration. The cells did not stain with sudan or osmic acid, but in Loyez' stain there was a remarkable deviation from the normal picture. While normally only the nucleolus is stained dark black, here there was finely granular black staining throughout the whole nucleus and a finer dustlike granu-

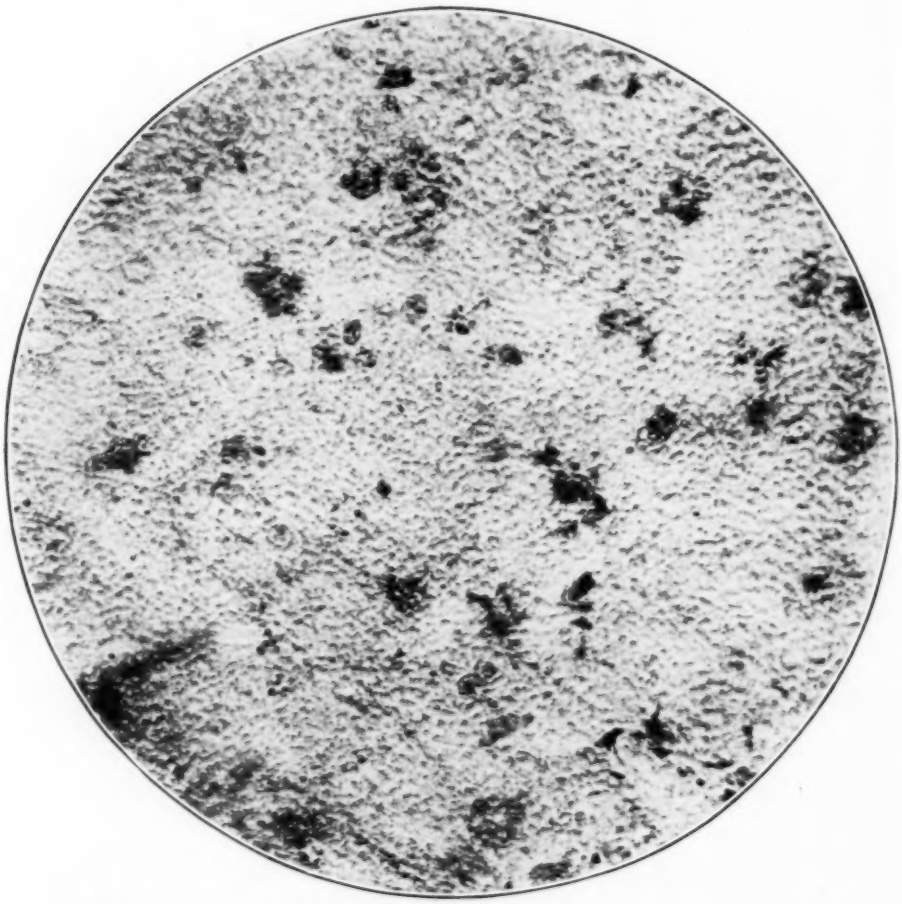

Fig. 5 (case 1).—Fat granules in glia cells and their processes. Sudan III; Zeiss 4 mm. ap.; comp. ocul. × 10.

lation of the cytoplasm. This process of swelling and affinity for hematoxylin was not so pronounced in the basal ganglia; the thalamus appeared almost normal; it was more pronounced in the olives and in some nuclei of the medulla. The cerebellum did not show any marked histologic changes. The localized swelling of the dendrons was noticed only in isolated cells.

Glia: There was pronounced increase in glia nuclei, particularly in the deeper layers of the cortex, alongside of many small dark-stained nuclei with fine punctate spots which showed fine black granulation in the Loyez' picture.

The glial elements also showed numerous fat droplets which stained with sudan III and scarlet red; the fat droplets showed no coalescence into granular cell formations, but followed the outline of the glia protoplasm; they did not stain with osmic acid. With del Rio Hortega IV and victoria blue stains no abnormal increase was observed in glia fibers.

Scattered throughout the brain, sieve-like areas were seen which contained bodies staining metachromatically with toluidin blue and gave a staining reaction similar to those described by Lhermitte, Kraus and Bertillon.[3] Glia nuclei were frequently seen, apparently within these bodies, causing them to resemble large

Fig. 6 (case 1).—Section through anterior horn of lateral ventricle. Comparison between normal picture and thickening of ependyma with increase of subependymal glia on the opposite side of the ventricle. Van Gieson stain. Zeiss 16 mm. ap.; comp. ocul. × 10.

gitter cells (fig. 10). Furthermore, with special stains and higher magnification, glia fibers were seen running through these bodies (fig. 11). They represent globular spaces within the glia meshwork containing metachromatic substances such as are frequently seen in other chronic diseases of the brain.

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3. Lhermitte, J.; Kraus, W. M., and Bertillon, F.: On Mucin-like Bodies in the Central Nervous System in Epidemic Encephalitis, Arch. Neurol. & Psychiat. **12**:620 (Dec.) 1924.

Ependyma: In many parts of the lateral ventricles the ependymal cells were increased in number and size. Instead of a single layer, one found from three to four layers of elongated cells. In the subependymal tissue the glia nuclei were enormously increased in number, especially the small, dark-stained nuclei. A striking contrast was formed by the normal lighter stained adjacent area (fig. 6). The choroid plexus was normal.

Mesoderm: The connective tissue around blood vessels was not increased nor were there any endarteritic changes. Slight edema of the meninges, with a few

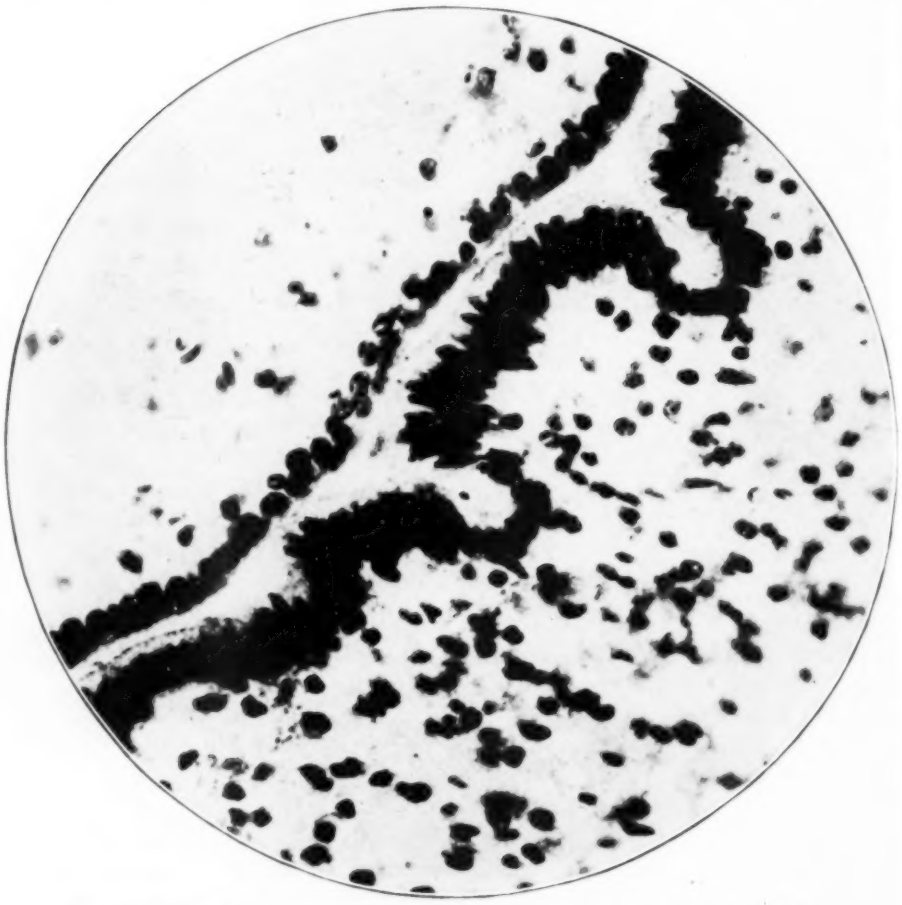

Fig. 7 (case 1).—(Same as fig. 6). Zeiss 4 mm. ap.; comp. ocul. × 10.

large round cells, was seen; there was no accumulation of gitter cells in the pia-arachnoid.

Summary.—Swelling of the ganglion cells with prelipoid degeneration, progressive glia changes with fixed type of abbau and proliferation of the ependyma were seen.

CASE 2.—L. R., a girl, aged 22 months, entered Lebanon Hospital with a history of progressive weakness for three months and rapidly diminishing vision

Examination.—This revealed hyperacusis with muscular twitching. The child was weak and could not sit up without support; the unsupported head would fall back. The ocular fundi showed atrophy of the optic nerve with the characteristic cherry red spot in the macula. After twelve days in the hospital, the child died of bronchopneumonia.

Necropsy.—Both cerebrum and cerebellum were exceedingly hard to the touch and on cutting after preservation in formaldehyde for two years they have become softer than normal.

Microscopic Report.—The swelling of the ganglion cells of the hemispheres was not so marked as in case 1. Only occasionally did one find localized swelling

Fig. 8 (case 2).—Section through inferior horn of lateral ventricle. Thickening of the ependymal layer and blurring of the outlines of the choroid plexus. Van Gieson stain. Zeiss 16 mm. ap.; comp. ocul. × 7.

of the dendrons. The cerebellar hemispheres and the dentate nucleus showed more striking changes. The Purkinje cells and processes were markedly swollen. The granulation with Loyez' stain was coarser. With Bielschowsky's stain one saw numerous irregular, swollen axis-cylinders. The endocellular fibrils showed the formation of clusters. Frequently, coarse black granules were seen in silver stains; there was no degeneration of the myelin sheath.

Glia: The glia nuclei were not so markedly increased as in the previous case, except in the occipital lobes, where they showed fine granulation with Loyez'

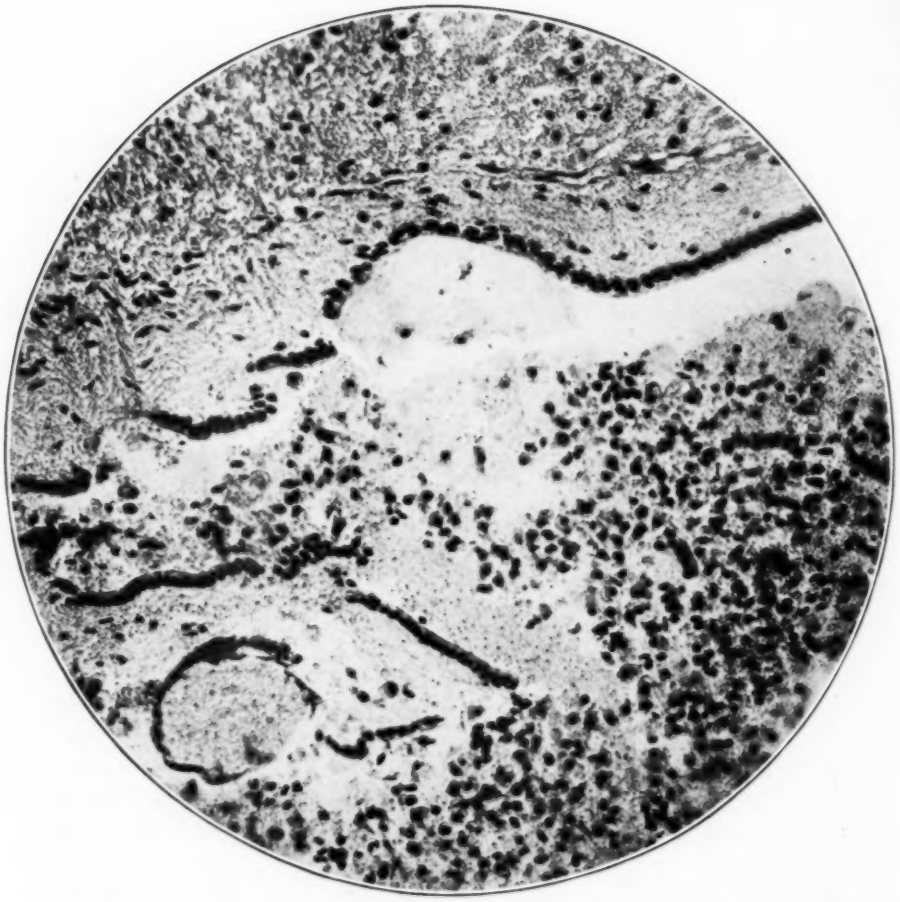

Fig. 9 (case 2).—Section through inferior horn of lateral ventricle. Destruction of ependymal layer and choroid plexus. Hematoxylin-eosin stain; Zeiss 4 mm. ap.; comp. ocul. × 10.

Fig. 10 (case 1).—Sievelike appearance of part of striate body. Van Gieson stain. Zeiss 8 mm.; comp. ocul. × 10.

stain. Fat stains gave negative results. With del Rio Hortega IV and victoria blue stains the fiber formation in the deeper layers of the cortex was more pronounced, and large astrocytes and monster glia cells were frequently noticed.

Ependyma: In the inferior horns of the lateral ventricles there was thickening of the ependymal layer with enlargement of the pale nuclei (van Gieson stain). In many places the cellular layer was broken down and replaced by large polygonal cells corresponding to the cells of the choroid plexus. The outline of the choroid

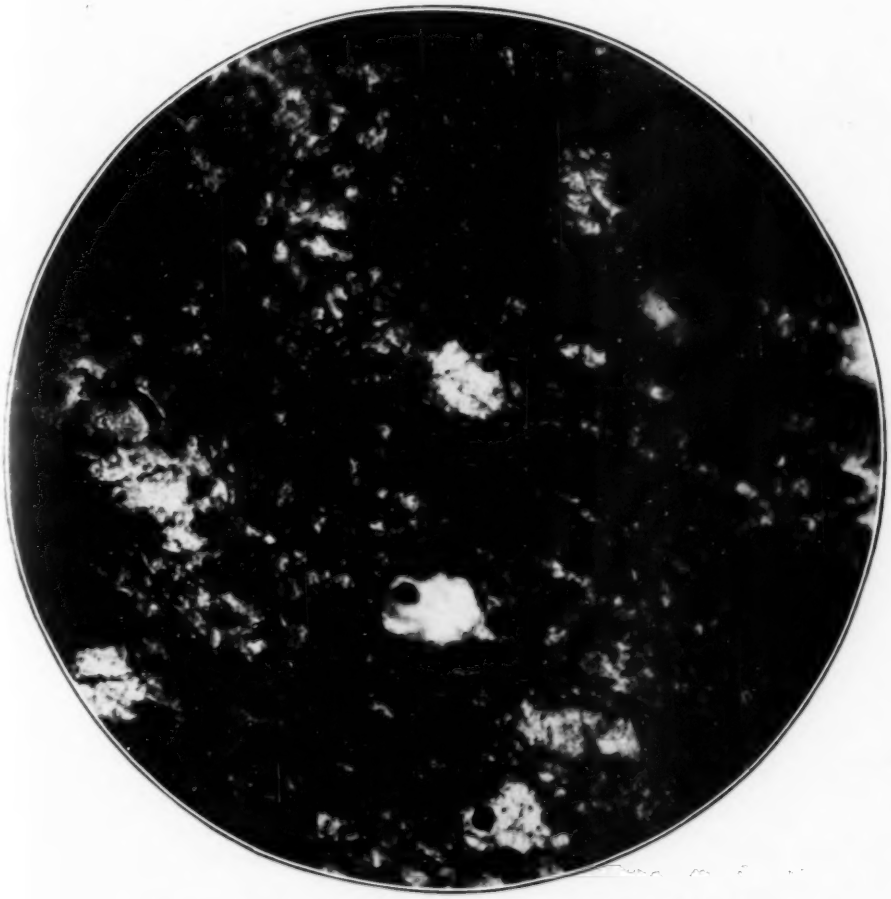

Fig. 11.—Same as fig. 10. Zeiss 4 mm. ap.; comp. ocul. × 10.

plexus itself was destroyed; its villi were glued together and broken down. There was marked increase of black-stained intracellular granules; There was no reaction of the subependymal glia layers.

Mesoderm: There was no vascular reaction; meningeal edema of medium degree was present.

Summary.—Cellular swelling, most pronounced in the cerebellum; hematoxylinophile granulations; swelling of axis cylinders; fibrous glia reaction of slight degree and degeneration of the ependyma and choroid plexus were seen.

COMMENT

Clinically, both cases presented the typical picture of amaurotic idiocy. Histologically, both differ from most of the infantile cases published by Schaffer and others in the absence of myelin sheath degeneration. In this respect they strongly resemble the juvenile type,

Case 1 comes nearer to the classic picture: swelling of ganglion cells with local swelling of the dendrons and prelipoid hematoxylin staining; formation of fat granules in the increased glia cells. In this case the pathologic process is confined mainly to the cerebral hemispheres; in case 2 the cerebellum is mostly involved. In case 1 the swelling of the axis cylinders is only suggestive; in case 2 it is much more pronounced, for the most part in connection with normal ganglion cells. In both cases the ependyma are involved; in most of the cases reported this has not been emphasized.

Both cases show a slowly progressive, chronic character, which is well demonstrated in case 1 by the fixed type of abbau of the glia. These observations do not correspond with the cases recorded in the literature in which marked fatty degeneration and complete destruction of the nervous parenchyma occurred, as in the case published by Hassin. We cannot confirm from our cases the conclusion reached by Hassin that the pathologic process of amaurotic family idiocy is most pronounced in the optic thalamus. His photomicrograph, figure 7, does not convince one that the sievelike appearance of the thalamus was really due to excessive formation of gitter cells, because of the low magnification. It appears to us rather to resemble the accumulations of lipoid droplets which are observed in many degenerative diseases of long duration and to which we have already referred.

We could find only mild histologic changes in the basal ganglia; they were relatively more pronounced in case 2. Reviewing our observations, we found in both cases a typical blastodermic (ectodermal) selectivity. The segmental selectivity was not uniform in character; in case 1 the cerebral hemispheres were more involved, in case 2 the cerebellum. As to the systemic electivity, we found that in case 2 the Purkinje cells were mostly involved; in case 1 we saw a preference for the deeper layers of the cortex in the process of swelling of the ganglion cells and glia proliferation.

Both cases reveal varying degenerative processes involving the different portions of the neuron. This holds true for the different components and elements of ectodermal origin of the central nervous system. Generalized conclusions from single cases, therefore, are not justified. In the entire group of infantile types of amaurotic family idiocy, we find a variety of subgroups with mutations in the pathologic pictures. The connecting links in this group are the ectodermal selectivity and the different degrees of Schaffer's type of cell degeneration, which was pointed out and emphasized for the juvenile type by Spielmeyer in 1906.

POSTENCEPHALITIC RESPIRATORY SYNDROMES

PHENOMENOLOGY AND PATHOLOGIC CONSIDERATIONS *

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This study is only a chapter in a larger setting forth of the entire syndrome, parts of which have already been presented; others are in course of appearance, and still others will be offered later. As many others have done, I [1] have sketched the development of this situation in its general outlines. Closer attention to the more specific syndrome of the present title followed, as I had had the privilege of attending the second Neurological Congress in Paris, in 1921, and had seen the patients of Marie and Lévy, of Souques and others, and had heard the discussion led by Souques [2] on the various phases of the parkinsonian syndrome. The same year, at the meeting of the Deutsche Gesellschaft für Nervenaerzte,[3] in Braunschweig, the same subject was taken up, chiefly by Pollack and Bostroem; further, numerous patients were personally studied in many of the European clinics.

A specific inquiry into the many phases was then taken up, and those related to the postencephalitic or tardy encephalitic respiratory phenomena were first chosen for consideration. These are in course of presentation, and the present paper deals with certain aspects of them. In one of the papers cited,[4] a general review of the literature is offered; two cases chosen from many are here given as paradigms, and I hope to present further considerations later.

A brief citation of the two cases may be permitted here. The more complete details are available as cited.[5]

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* Read in abstract at the Fifty-Second Annual Meeting of the American Neurological Association, Atlantic City, N. J., June 1, 1926.

1. Jelliffe, S. E.: Lethargic Encephalitis, New York M. J. **111**:412 (March 6) 1920; Nervous Syndromes in Influenza, in Crookshank, F: Influenza, London, Heinemann, 1922, p. 351; Somatic Pathology and Psychopathology at the Encephalitis Cross Road: A Fragment, J. Nerv. & Ment. Dis. **61**:561 (June) 1925; A Neuropsychiatric Pilgrimage, ibid. **56**:239, 1922; given more fully in Studies in Psychiatry, New York Psychiatric Society, Nerv. & Ment. Dis. monograph no. 41 **2**:177, 1925; Postencephalitic Respiratory Disorders: Review of the Syndrome, Case Reports and Discussion, J. Nerv. & Ment. Dis. **63**:357 (April), 467 (May), 592 (June), and **64**:29 (July), 157 (Aug.), 241 (Sept.), and 362 (Oct.) 1926.

2. A report of the discussion by Souques and others on the parkinsonian syndromes is given in Rev. neurol. **37**:534 (June) 1921.

3. A report of this meeting is given in Deutsche Ztschr. f. Nervenh. **74**:1, 1921.

4. Jelliffe (footnote 1, fifth reference).

5. A complete report of case 1 appears in J. Nerv. & Ment. Dis. **64**:29, 1926, and of case 2, ibid. **64**:157, 1926.

ABSTRACTS OF CASES

Case 1.—This deals with a boy, aged 18, who had a mild "cold in the head," then a definite night delirium in which he saw "angels," and was apparently quickly restored to health and returned to school. Then nasal sniffling and complaints of nasal obstructions began; there was then an automobile accident with nose implication, followed by respiratory sequelae. These were of the classic tachypneic variety, involving both intercostals and diaphragm, with apneic phases, trance states, tetany cramps, occasional semiconscious lapses or trance-like states (which should be compared with the stuporous attitudes described by Bilancioni and Fumarola), sleep formula reversal, behavior anomalies, and then parkinsonism, with greasy face, sialorrhea, polyuria and polydipsia.

Fig. 1.—Beginning of attack. Puffing three minutes, 60 to the minute.

Comment.—The patient was seen previously by two members of the American Neurological Association, one of whom briefly described the condition;[6] this account has been used in the descriptions already mentioned and may be referred to as a check on my judgment on the outcome in this case attendant on the psychanalytic method of treatment. After six or seven months of this aspect of psychotherapy, excellent results in all humility may be claimed definitely. As the therapeutic results heretofore reported in the literature have been negative, except

6. Burr, C. W.: Sequelae of Epidemic Encephalitis Without any Preceding Acute Illness, Arch. Neurol. & Psychiat. **14**:20 (July) 1925, case 1.

possibly in the cases of Runge and Witzel, also cited in the previous studies, this emphasis may not be unjustified, especially when brought in apposition to the gloomy prognosis offered in the report by the colleague referred to.

Case 2.—A woman, aged 26, had a mild cold in December, 1924, and then developed a talkative hypomanic state with hallucinations of bugs crawling on the ceiling, which lasted from two to three days. This was followed by a definite,

Fig. 2.—Ten minutes—trance state which lasted from two to three minutes —whole attack about ten minutes.

fleeting diplopia and a deep lethargic state. Some weeks later a respiratory sequel and a pronounced sleep reversal formula began. The respiratory attacks were tachypneic, irregular and were participated in by both intercostal and diaphragm muscles. With increasing tachypnea and almost continuous (fishlike breathing) sharp expirations, parkinsonian attitude, sialorrhea, polyuria and polydipsia appeared. The patient was still under treatment, three months later, in June, 1926, with no appreciable improvement from conscious levels.

Comment.—This condition will undoubtedly prove obstinate if at all treatable, since there are pronounced hereditary factors—psychoses

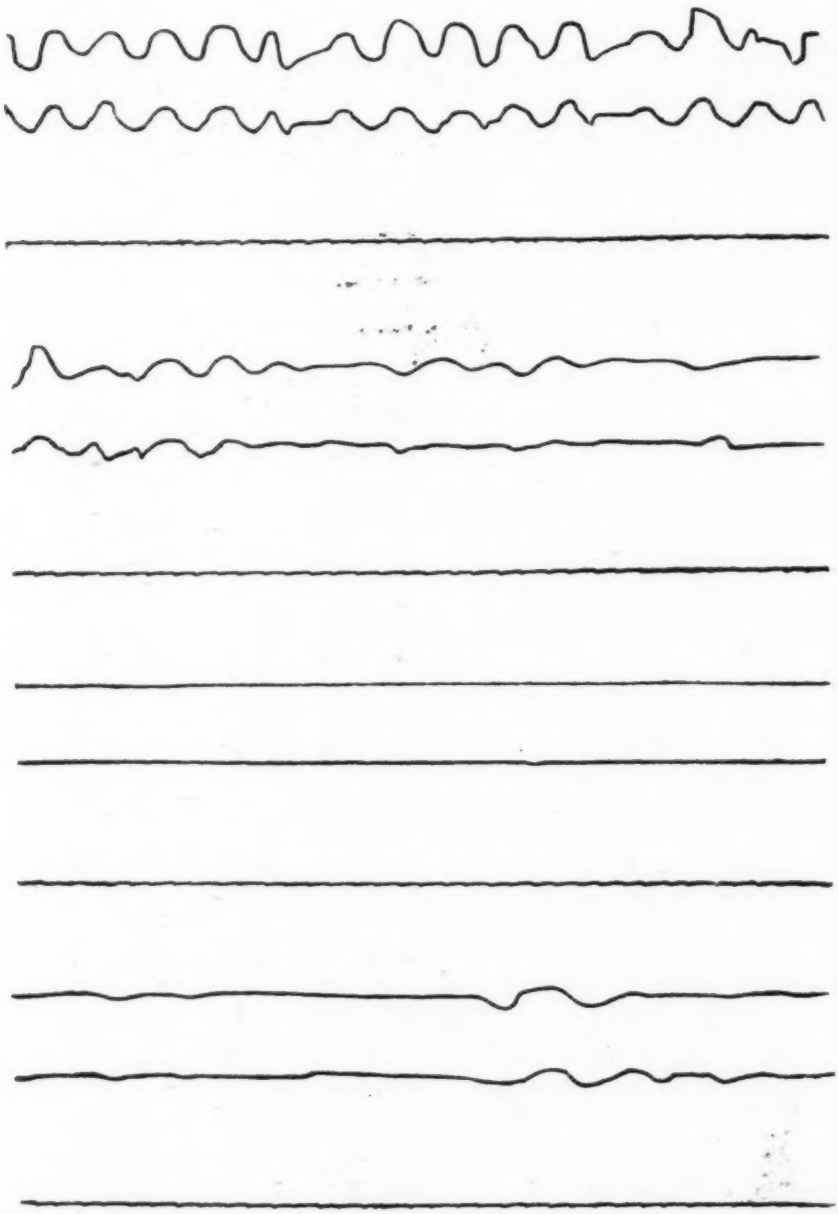

Fig. 3.—Pneumographic tracings of an attack. End of apneic phase, resumption of normal breathing. Ended at 4:40 p. m., Sunday, March 22, 1925. First line indicates intercostal breathing; second line, diaphragmatic breathing, and third line, time markings at rate of 72 per minute.

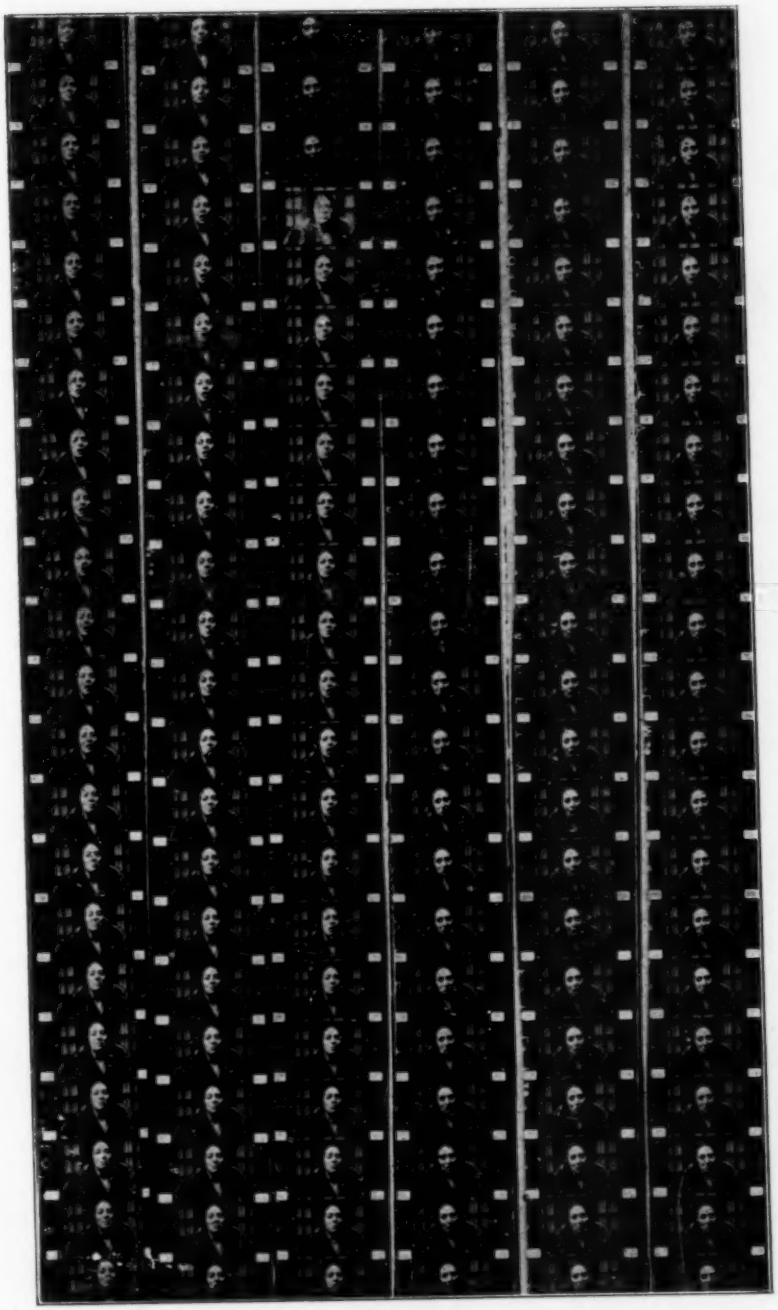

Fig. 4.—Cinematograph film of gasping attacks.

in the mother's family (?), a pronounced gastric psychoneurosis in the father, and postencephalitic dementia praecox behavior (hospital internment) in a brother. Moreover, the patient herself had never conquered the thumb-sucking stage before becoming ill and had always been obstinate and self-willed.

Fig. 5.—Enlarged film studies of mouth movements in gasping breathing. Six of sixteen pictures taken in one second. Column should be read left downward, then right.

SCOPE OF THIS ARTICLE

This aspect of the study deals only with the phenomenology of these and related breathing attacks of others, as already abstracted, and with certain somatic pathologic aspects. A discussion of the psychopathologic condition, which is deemed of paramount importance, will be

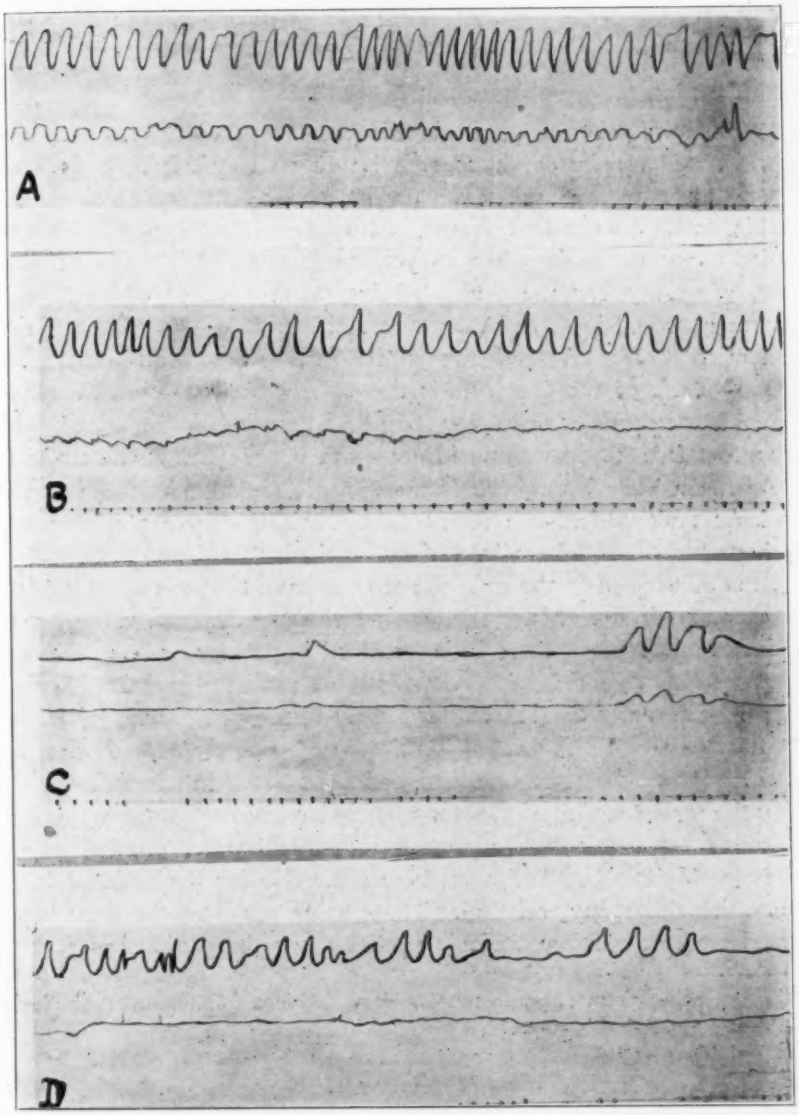

Fig. 6.—Pneumographic tracings of an attack. Phase of tachypnea in which thoracic (upper line) and diaphragmatic (lower line) muscles are synchronously involved.

presented later, although a few necessary comments will be made. Furthermore, the larger study projected will deal more extensively with both the phenomenologic and the pathologic aspects. This paper must therefore be considered as an abstract of the other studies.[7]

PHENOMENOLOGY

A complete presentation of all the phenomena that accompany even the restricted respiratory syndrome is not contemplated. This would require an extensive portrayal of physicochemical, physiologic and psychic data. In the first frame, it may be said that physicochemical studies along these lines are as yet incomplete. They are of much value, especially for the understanding of a number of metabolism changes observed in encephalitis cases. Tetany, as one of these, need be mentioned only (Adlersberger and Porges, Rossett, and others).

This phase of the problems is therefore passed over and emphasis is placed on a brief review of certain pathophysiologic situations, while only a tentative consideration of the psychic coordinates is contemplated.

As the mode of approach is mechanistic and dynamic rather than nosologic and static, such terms as hysterical, degenerate, dementia, psychopathic, neurotic, etc., are of no particular significance.

In another paper,[4] the essential studies have been gathered more or less chronologically. Many of these which are of special value for the respiratory movements have been observed in greater or less detail and graphically represented by the methods in use at present. They are naturally uneven in detail. I refer chiefly to the earlier ones of Bériel,[8] Hardoin,[9] Gabrielle Lévy,[10] Bilancioni and Fumarola,[11] Turner and Critchley [12] and others to be mentioned (Mendicini in particular).

In the earlier period of the study of epidemic encephalitis, respiratory syndromes were observed in great numbers and were recorded in particular by Mendicini. These are here put aside for the residual forms with which this study will deal. These acute manifestations are not to be neglected, as many pathologic studies show that death has resulted

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7. Appearing as monograph no. 45, Nerv. & Ment. Dis. Monograph Series, New York and Washington, 1927.

8. Bériel, M. I.: Troubles respiratoires, Rev. neurol. **37**:640, 1921.

9. Hardoin, B.: Étude des troubles respiratoires dans les états parkinsoniens liés a l'encéphalite épidémique, Dijon, 1921.

10. Lévy, Gabrielle: Contribution à l'étude des manifestations tardives de l'encéphalite épidémique, Thése de Paris, Doin Frères, 1922, p. 439.

11. Bilancioni and Fumarola: Su alcone rare manifestazione a forma bulbare (laryngee e respiratorie) della encephalitis chronica epidemica, Ann. inst. med. Naples **29**:1, 1922.

12. Turner, W. A., and Critchley, M.: Respiratory Disorders in Epidemic Encephalitis, Brain **48**:72 (March) 1925.

from involvement of the respiratory neural mechanisms essential for the oxidative function of the lungs (Goldflam et al.); hence, inferentially, in the residual respiratory disorders, which are strictly homologizable with the acute respiratory syndromes, some impingement on these complicated mechanisms must be admitted as playing a part in the residual types under specific consideration. It is probable also that the anomalies of muscular movements involved in respiration are in many ways to be coordinated with other muscular anomalies found in the general encephalitic syndrome. Achard, in his monograph, has drawn attention to the similarities of myoclonic diaphragmatic breathing

Abb. 4. (a) Mikropnoe; (b) Seufzer.

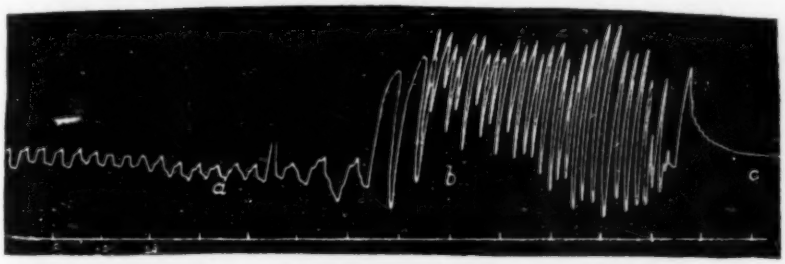
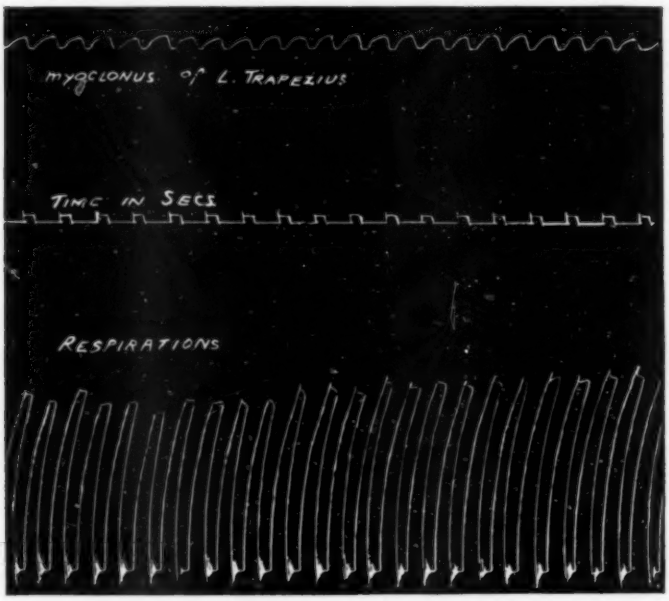


Fig. 7.—In top picture, *a* indicates micropnea and *b*, "seufzer." In lower picture, *a* indicates micropnea; *b*, tachypnea; *c*, apnea. Characteristic respiratory curves (Suckow).

to other myoclonias. Reys' contribution [13] is of similar import. Similarly, Cheyne-Stokes breathing with its usually lethal outcome is partially imitated in less severe forms. Mendicini's initial pneumographic study of breathing anomalies in the acute stages shows how striking are the similarities found in the residual syndromes.

From the interpretative side, Bériel's study, elaborated in Hardoin's early thesis (1921), first enters the field seriously. After illustrating respiratory tics, they speak of a special form of micropnea in parkinsonian cases in which the respirations are rapid and superficial and in which the diaphragm alone is active. There is no paralysis, and Hardoin states that neither central nor peripheral neural processes are involved. The thoracic rigidity is the essential feature. This rigidity

13. Reys, L.: L'encéphalite épidémique, Paris, A. Maloine et fils, 1922.



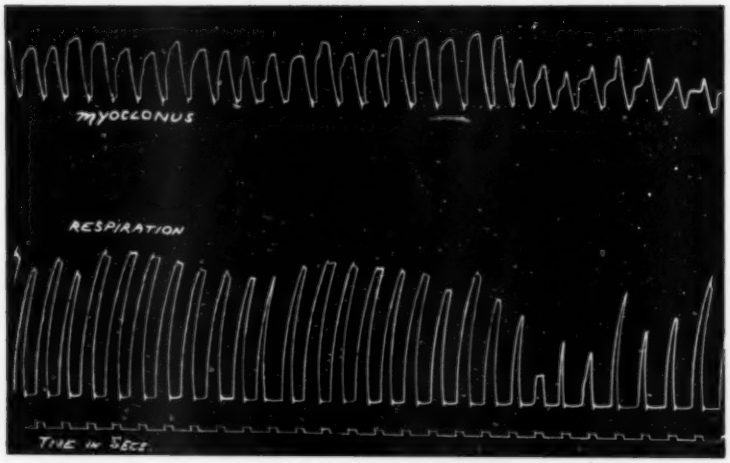


Fig. 8.—Tracings taken from case 4 of Turner and Critchley, recording simultaneously myoclonic movements of the left trapezius and respiration. The rapid rate of breathing and also the synchrony between the myoclonus and the respiration are shown (Turner and Critchley, figs. 11 *a* and 11 *b*).

they compare with the so-called parkinsonian rigidity. Hardoin correlates the brusk ticlike movements with a diaphragmatic myoclonic spasm. It is an accident of compensation arising in the course of the micropnea. He relates these to some somatic disturbance. These myoclonic cases are of special significance, as the experiments of Gamble, Muller and their associates on phrenic nerve freezing which has stopped these myoclonias are of great theoretical as well as practical importance, but must not be extended beyond their proper sphere.

Bériel says that bulbar involvements are not probable; paralyses of the intercostals, the diaphragm and the pneumogastric as well are to be excluded. Superior nuclei of coordination such as may lie in the corpora striata may possibly be involved, but the author passes this by

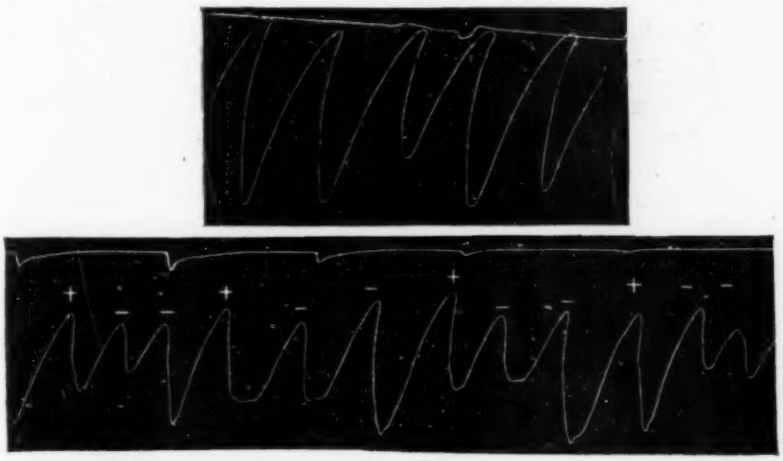


Fig. 9.—Respiratory arrhythmia with alternating type above and below fragment of a trigeminal type (Van Bogaert).

too lightly and formulates the hypothesis already mentioned, that of "thoracic rigidity" of a nature allied to parkinsonian rigidity. Radioscopic study showed complete immobilization of the base of the thorax. Laignel-Lavastine reports similar observations. Thus, as Bériel has pointed out, other micromotor syndromes find their analogs in this micropnea. Micrographia, minimal movements of the jaws and other associated micromuscular activities are cited.

The acceleration in the breathing rate is thus, in their view (shared by others), a compensatory process founded on oxygen need. The diaphragmatic exaggerations therefore stand in liaison with the thoracic fixation. Bulbar implications are not of help in the explanations, but Hardoin admits that higher coordinates—corpora striata—may be implicated.

I admit that Bériel and Hardoin's point of view has partial validity for a certain number of these cases; but it is certainly a part of the present task to learn, if possible, more of the complex mechanism of respiration, not only in its purely oxidative function but also as to the relations of chest and diaphragmatic movement as carriers for higher symbolic equivalents, with which present day science is fairly well acquainted in its speech mechanism activities.

Laignel-Lavastine and his assistants have also demonstrated an asynergia in the automatic respiratory movements with a dissociation between the right and left halves of the diaphragm. Here is a difficult problem that present day knowledge must leave for a time.

CLASSIFICATION OF RESPIRATORY DISORDERS

To return to a more systematic mode of inquiry, Turner and Critchley, to take the most recent of the many studies, have followed Gabrielle Lévy's classification with slight modifications. They arrange the material as follows:

1. *Disorders of Respiratory Rate (Tachypnea and Bradypnea).*—In the Lévy grouping, the respiratory disorders proper are: alterations

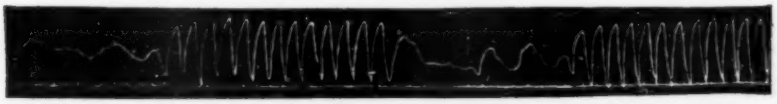


Fig. 10.—Lévy's illustration of persistent tachypnea. During writing the breathing alters, as also shown in Hardoin's curves of change in breathing during swallowing (Lévy, fig. 31, p. 142, Doin).

of rhythm—polypnea chiefly (tachypnea is preferred by Turner and Critchley), bradypnea, apnea and accessory periodic respiration.

2. *Dysrhythmias or Disorders of Respiratory Rhythm.*—These are Cheyne-Stokes rhythm, breath holding spells, sighs, forced or noisy expiration and inversion of the inspiration—expiration ratio.

3. *Respiratory Tics.*—These are yawning, hiccup, spasmodic cough and sniffing.

Various combinations of these types may coexist with or without the other sequels of encephalitis, according to Turner and Critchley. To this one may agree, except that as yet no single case of pure respiratory disturbance which does not show one or more of the now accredited "encephalitis" signs has come to my notice if careful scrutiny is made. If such a respiratory syndrome, "absolutely pure," should be found, "encephalitis" causal factors would not be excluded, but one would be inclined to hunt psychanalytically for a characteristic psychogenic goal and hence would ally such a case with the purer hysterias, compulsion, schizoid or other symbolic mechanisms, i. e., nosologically speaking.

Turner and Critchley discard Lévy's much used term polypnea entirely, although they follow her general descriptive outline. Tachypnea (Turner and Critchley), or polypnea or tachypnea (Lévy), is the commonest of the respiratory anomalies (the most important, according to Lévy). It may be permanent or paroxysmal, occurring during sleep or only during the waking hours. Both have been observed, but in cases 1 and 2, the tachypnea was present only during the waking hours, except in a few instances of half sleep when tachypnea was continuous in both.

Turner and Critchley state that there may be no cyanosis; in both of the cases here reported there were apneic periods with cyanosis, and

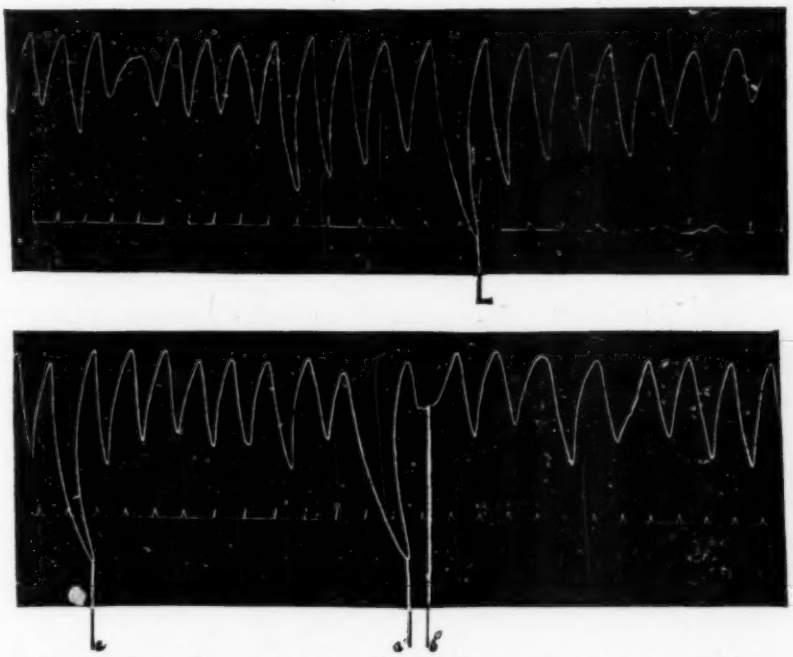


Fig. 11.—Irregular tachypnea with sighing, deep dip in graphic. In lower figure tendency to irregular breathing with sighing. Same patient as previous graphic (Lévy, figs. 31 and 32, p. 143, footnote 10).

most of the cases abstracted in the larger study [4] have shown an apneic phase with trancelike states or semiunconscious phases and cyanosis. Turner and Critchley speak of the patients usually suffering no inconvenience. Such has not been the experience with the patients here reported nor with the numerous ones seen in various clinics where nearly all have complained of great inconvenience and of intense effort in getting their breath, at times almost agonal in intensity. Mild cases without agonal phases are, however, conceivable.[14]

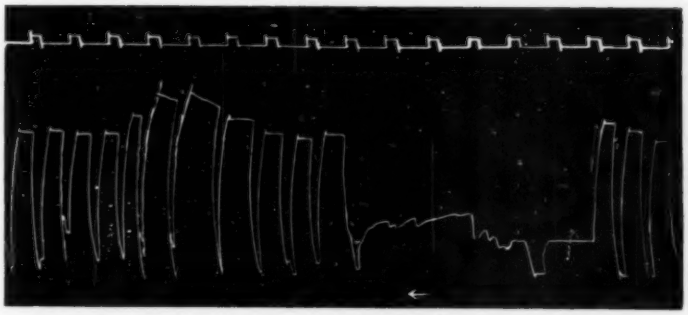
14. Kennedy, F.; Davis, T. K., and Hyslop, G. H.: An Additional Contribution to the Symptomatology of Epidemic Encephalitis, Arch. Neurol. & Psychiat. **8**:40 (July) 1922.

According to Turner and Critchley, the fixation of the chest observed by Bériel and Hardoin obtains in the parkinsonian cases only. According to Lévy, paroxysmal (polypnea) tachypnea is the most frequent type; this has been my experience, and the historical resumé bears this out. Lévy lays stress on the "toward evening" occurrence of these attacks, and Turner and Critchley speak of it also, when the attacks may last from a few minutes to several hours. In the cases here cited no such (symbolic?) determiners were found. Lévy states that this evening oncoming situation was particularly true for children and often lasted all night. My experience has not dealt with many children; and hence this situation has not been analyzed particularly.

The breathing attacks according to most observers are under some sort of voluntary control. Emotional stimuli are of much moment in inducing or modifying them. Turner and Critchley state that eating may stop them. In case 1 and case 2, eating time was a particularly efficient stimulus in inducing the attacks. Paroxysmal or permanent tachypnea seems to be a quantitative grade in my experience. As some patients recover spontaneously for reasons as yet inexplicable (with the exception of those here advanced for some recoveries), the permanent types tend to give way to paroxysmal types, and such a course argues for beginning partial or complete recovery. Turner and Critchley call attention to Buzzard's observation concerning the dissociation of many complicated activities in encephalitis during which purely automatic activities such as swallowing, speaking, breathing, etc., seem to be split and become possible only under directed voluntary activity. This feature of functional dissociation is of much significance from the genetic point of view of behavior and is developed more in extenso in my larger study.

Brief mention has been made of the tetaniform complications consequent on the hyperventilation of the lungs in the paroxysmal and permanent tachypneas. The observations are old, although Barker and Sprunt have spoken of them as new. These have been dealt with in the opening paragraphs of the historical résumé already cited and, as they bear specifically on the chemical problems involved, cannot be entered into here even though far reaching situations are involved. Adlersberg and Porges have offered an introductory chapter to this, and the subject must be left here.

Case 2 offered an example of what has been described as a persistent tachypnea—yet it was evident that periodicity was present. Close scrutiny of the records of the many cases already cited tends to show that there is no really permanent tachypnea. Even in the cases cited by Lévy and in her pneumographic tracings, there is evidence of a certain periodicity. There is a rise and fall in the intensity of the breathing spells, and attacks can be separated even though the interval at times seems slight.



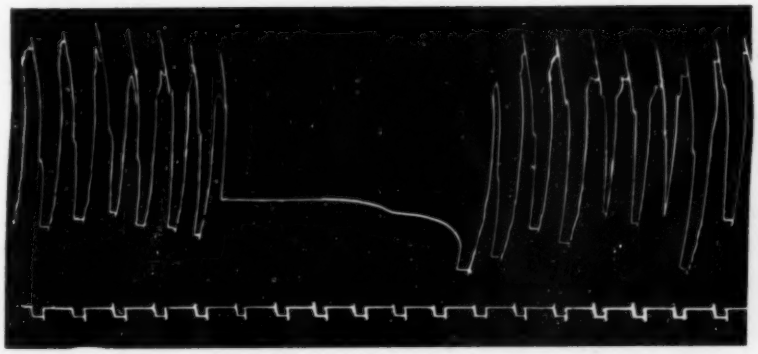


Fig. 12.—Pneumograms of case 1 of Turner and Critchley, showing respirations irregular in time and spacing, interspersed with periods of apnea. *X* indicates apnea in almost full inspiration; *y*, forceful expiratory effort, and *z*, short periods of acapnia.

In case 2, which is one of the most severe I have seen, there would be five, ten or fifteen minute intervals between attacks—apparently related to diversion or other incidents. Sometimes a free interval of an hour would occur. The attack would terminate with one or more deep yawns, which were accompanied by a feeling of deep satisfaction. Such satisfaction failing, the breathing would go on. With a satisfactory deep yawn after several smaller ones, the patient would either enter an apneic phase with increasing cyanosis or would be free from the attack for a while. The psychanalytic correlation with an orgasm [unconscious], sialorrhea, or leukorrheal discharge was evident in both cases given as paradigms and will be discussed in the section of this study dealing with psychopathology.

Lévy groups these sighing, yawning episodes with the tachypneas; Turner and Critchley speak of them as belonging in their second group. To me they belong with the whole unconscious mechanism and are

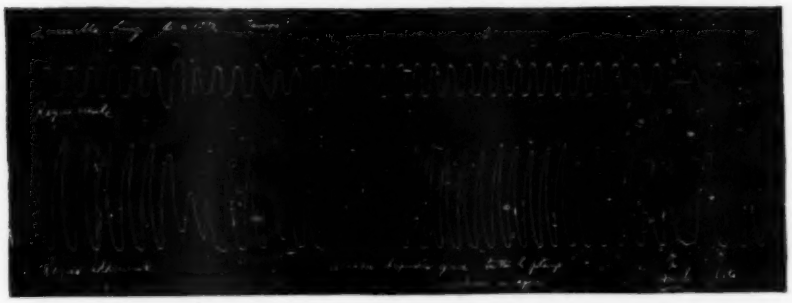


Fig. 13.—Frequent panting; irregular breathing correlated with psychic factors of distraction or of stuporous make believe (Bilancioni and Fumarola, p. 22, footnote 11).

of special significance when one views the whole situation teleologically. As no one but myself, Witzel, and Runge have dealt with this phase of the pathopsychophysiologic situation, I reserve discussion of these until later and will here adhere to the descriptive phases.

Most authors speak of these sighs as extremely frequent and as occurring in normal breathing followed by a short period of compensatory expiratory apnea. This apneic situation is to me of great psychologic significance, especially when considered from the psychanalytic point of view of early libido distribution between breathing and sucking in the infant. Turner and Critchley speak of the sighs as occurring only during sleep or following slight exertion. Ticlike grimaces (Turner and Critchley) and spasms (Lévy) are noted "Shivers" were present in both my cases and were homologized to the involuntary "shudders" often experienced when the bladder is emptied, etc. (orgasmic analogs, urethral erotic level, envisaged psychanalytically).

Apneic phases, described by Turner and Critchley, Lévy, and Bilancioni and Fumarola, were marked in my patients. With my cases they are clearly homologized with "unconscious" situations of rapt attention—"trance" (Bilancioni and Fumarola); my analysis shows their homology with enraptured and trance states as seen in narcoleptic, hypnoleptic, cataleptic, epileptic, and in so-called "possession" and "mystic raptus" situations. Here are a series of phenomena involving dissociation of great interest and complexity which run back to infantile fixations of rapt interest in which artistic intuition of the significance of the "Transfiguration," "Danae," "Leda and the Swan"—not to mention many variants from the upper reaches of spiritual transport to the lower

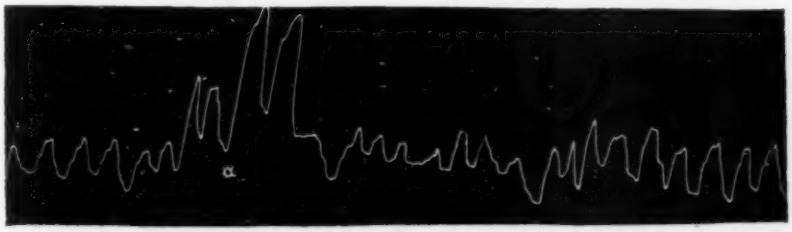


Fig. 14.—Sighing, yawning respiratory curve (Suckow).

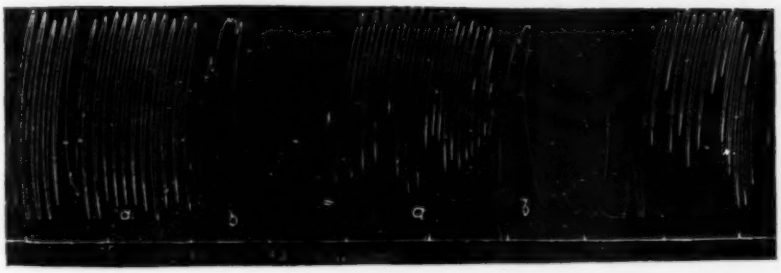


Fig. 15.—*A* indicates tachypnea and *b* apnea. Type of alternating tachypnea and apnea (Suckow).

grades of licentious involvement—are to be evaluated. It is not to be inferred that such trancelike states are necessarily to be correlated in this way. In common sense terms "every tub stands on its own bottom"; and hence only detailed study of the individual patient can determine the exact situation.

Irregular respiration, bigeminal and trigeminal, dissociated costal, thoracic, nasal or laryngeal types are frequently encountered. It is certain that each of these modifications in turn has its special significance. The personality make-up of the individual patient is probably of considerable significance. There is little available evidence on this point, but students of speech, singing, elocution, etc., are well acquainted with

such variations as pertaining to such backgrounds. Bilancioni and Furmarola discuss these laryngeal and related features extensively but solely from the clinical, descriptive point of view.

In case 2, for instance, the prolonged expiratory phase corresponds with other individually characteristic breathing situations. This patient always had a tendency to discharge her speech explosively. Furthermore, this personal feature was pronounced when she smoked a cigaret. Whereas many individual smokers find that inhalation is most pleasurable, with this patient strong exhalation was the preferred type of activity. Naturally she was, as already indicated, obstinate, and "no" was always ahead of "yes." Her negativism has certain analogs to a schizoid mechanism and counsels caution in prognosis.

As one studies the many pneumographic tracings on record, these irregular types are plainly in evidence. They are present at times in almost all cases, even though a predominant breathing pattern tends to

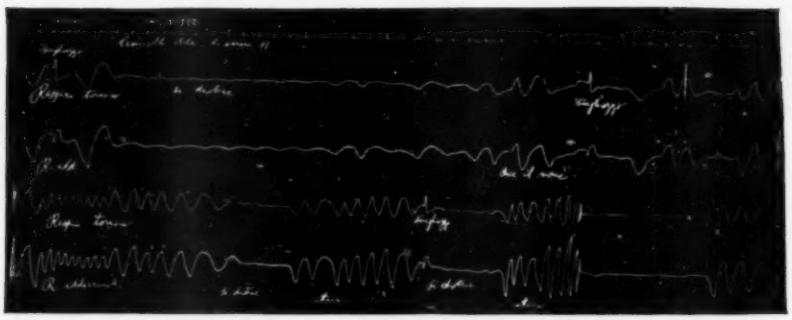


Fig. 16.—Same patient as described in figure 13. In this period, the patient falls easily into a stuporous state, semiecstatic, in which the respiratory movements are reduced to a minimum. In the two lower graphic tracings the patient shows frequent attacks of dyspnea alternating with pauses, the former arising without apparent cause (Bilancioni and Fumarole, p. 40, case 9, footnote 11).

be followed by each patient. Bilancioni and Fumarola's tracings are especially interesting from this angle, although no psychologic correlations are offered.

Turner and Critchley emphasize breath-holding episodes. They refer to those who hold the breath in deep inspiration. "These paroxysms are ushered in by a series of deep, forced inspiratory efforts with noisy expirations; the patients feel dizzy," or as if there was something in the chest interfering with full inspiration. A deep inspiration is then taken and maintained for a period of ten, twenty or thirty seconds. Choreo-athetoid movements, grimaces or bizarre movements may accompany these. Sometimes consciousness is cloudy during them as in their cases 1 and 5 and in my case 1.

Case 2 showed a partial reversal of this formula. The patient simply stopped breathing. The patient in case 1 would go into a trance sometimes lasting a long time—five minutes, with cyanosis, cold extremities, tetaniform cramps in hands and feet and, as recorded, a few almost epileptiform states. In case 2, the patient would stop breathing, become cyanotic after a few great yawns, then after from five to thirty seconds would start on her labored breathing. If the yawn was "satisfactory," the apneic phase might be omitted and she would talk for from five to fifteen minutes, sometimes even longer, and then another paroxysm would supervene. With her there was some subtle unconscious correlation between something obtained by the yawn and the apnea. One hesitates here to refer to Ferenczi's study [15] on the phyletic phases of genital organization, in which he would show the relation between the death wish and the life wish, ambivalently expressed in impregnation. The better the yawn the less the apnea. Shivering attacks sometimes would follow an apnea, but rarely occurred when there was a good yawn.

A similar series of displacements was also seen in case 1. The wish to micturate and the shivering attacks were in some way correlated as well. Lévy [16] has called attention to involuntary micturition in one case associated with spasmodic cough. The patient in case 1 would go to the toilet after a severe breathing spell. The patient in Wimmer's [17] case 12 had had nocturnal enuresis for many years.

The general behavior of other patients during these breathing spells deserves a special chapter, but is reserved for the larger chapter mentioned. Only Runge's patient may be cited,[18] in that the attempt to "strangle himself" might be brought into relief as possibly related in some manner to the apneic intervals. As apnea might be thought of as a special mode of strangling (self-destruction wish), Runge's theological student, with his ideas of sin—present also in modified form in my case 2—is thought of as deserving special comment, and possibly to be related to the psychopathologic condition of certain of these cases. The Roch-Schmidt patient who tried to hide and others who banged themselves on the floor might also be compared with the regressive suicidal-wish phantasy situation. Runge's case deserves more extended study, as does Hauptmann's extensive autobiographic case.

A final word may be said concerning the minor respiratory phenomena classed by Lévy, Turner and Critchley and others as tics.

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15. Ferenczi: Versuch eine Genitaltheorie, Vienna, Int. Psa. Verlag., 1925.

16. Footnote 9, p. 14.

17. Wimmer, August: Chronic Epidemic Encephalitis, London, Heinemann, 1924, pp. 352.

18. Runge: Psychopathie von chronische Encephalitis epidemica mit eigenartige Symptomatologie (larvierte Onanie), Arch. f. Psychiat. **68**:429, 1923.

Bignami,[19] as early as 1920, drew attention to these and allied them with Dubini's electric choreas. Zingerle [20] and others have allied them with diaphragmatic myoclonias. Since this enters into the large group of hiccup cases,[17] with Turner and Critchley I mention them only.

Other nose sniffling and mouth blowing tics are also omitted from full mention here. Lévy, Francioni,[21] Parker, Babinski and Charpentier and others note them. The nose sniffling attacks were pronounced in case 1 and led to a nasal operation. Wimmer deals with them clearly; he speaks of constant sniffling, hawking and spitting. Noisy puffing, hissing or snorting through the nose or mouth, paroxysmal or phastic, are the terms used as well as serial yawning or sighing and hiccuping.

Fig. 17.—Photograph of patient 2 of Turner and Critchley illustrating the wide involuntary opening of the mouth—yawning attacks.

Wimmer's case 12 presented pronounced yawning attacks antecedent to a tachypnea. The patient had jerky fits, as many as twenty a day—later 135—and her tachypnea would rise to seventy noisy respirations to the minute. This patient is of further interest in that she showed pronounced attacks of hiccup for a year previous to the onset of the respiratory syndrome.

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19. Bignami, A.: Sui rapporti tra la corea elettrica di Dubini e la encefalite letargica, Riv. os Sed. **10**:527, 1923.

20. Zingerle, H.: Beitrag zur Kenntniss des extrapyramidalen Symptomencomplex, J. f. Psychol. u. Neurol. **27**:166, 1922.

21. Francioni: Ancora sopra le alterazione del respiro nella encefalite epidemica, Cerv. **2**:30, 1923.

Whooping cough-like attacks have been studied by Marie and Lévy and others, and are noted as introductory to later respiratory difficulties by many authors (case 1 of Turner and Critchley).

Yawning attacks have also been recorded by many observers. My case 2 is a classic example—also Turner and Critchley's case 2, and cases by Abrahamson, Buzzard, Howell, Pardee, Mayer and Saussure, Sicard and Paraf, Wimmer and others.

It is often stated that these tics may occur as isolated phenomena, but closer study nearly always reveals other respiratory situations. Many observers fail to mention any of the tics. As Turner and Critchley note, possibly they were not looked for.

Bilancioni and Fumarola, Lévy, and many others refer to the "hysterical," "pithiatic," "hysteriform" (Wimmer) nature of these phenomena, and Lévy devotes some pages to arguments as to their "organic" nature. Most authors seem steeped in the parallelistic or dualistic doctrines of old time neurology. As this type of presentation does not appeal to the present attitude, since here the psyche is deemed as old as the soma and "coterminous," the discussion of the pathogeny problem involved is only touched on here; it will be discussed more in detail in the larger discussion promised.

PATHOGENESIS OF THE RESPIRATORY SYNDROMES

As has been pointed out, there is an enormous diversity of the phenomena already envisaged as respiratory. No single formula is possible as offering explanation of the pathogeny of the respiratory attacks, any more than for the larger encephalitic syndrome. Turner and Critchley, in discussing this phase, say that "at the present time the discussion as to the causation of the postencephalitic respiratory disorders becomes purely speculative." While agreeing in the main, cannot one express it better by saying that certain of the phenomena can be ascribed definitely to certain lesions while others are still too complicated for analysis as yet? Thus, on the one hand, the Cheyne-Stokes breathing, so often seen in acute situations and persisting at times, partly modified, into the later stages, is structurally comprehensible.[22] At an opposite pole, in which psychogenic factors can be seen to be operative, the results of diaschitic splitting, or dissolution of function, due to partial involvement of higher cortical reflex pathways is still insoluble. Until more is known of cortical pathoclisis, the structural correlates here will remain unknown. Pathogenic interpretative formulas for intermediary situations, possibly seen statistically as pre-

22. Ballif and Marza: Troubles respiratoires et mentaux sequelles d'encéphalite lethargique chez les enfants, Bull. Asoc. d. Psychiat. d. Roumanie **6**:113, 1923.

ponderating, remain, as Turner and Critchley state, undetermined by reason of a multiplicity of factors that are hence speculative.

An historical review of the general situation brings out the complications surrounding any monistic interpretation. Turner and Critchley summarize these as follows:

1. *Peripheral Origin Hypotheses.*—These are described by Bériel, Hardoin, Vincent and Bernard, Laignel-Lavastine (diaphragmatic dissociation), and others.

2. *Various Thalamic Hypotheses.*—Here the afferent stimulus is thought to be blocked, and thus the phenomena are brought in line with the thalamic sleep hypotheses (Jeliffe, Pardee et al., for sleep).

3. *Bulbar Localizations.*—These are shown definitely in severe involvements (Goldflam et al.) for specific types—Cheyne-Stokes, etc.—and assumed for attenuated forms (Roche, Ballif and Marza, Rosenow, and others).

4. *Higher Psychomotor Tract Involvements.*—Turner and Critchley advance the situation a bit in these; the involvements will be discussed here as relevant to the general dissolution of function aspects, since respiratory function as such is known to have voluntary cortical regulatory mechanisms. Furthermore, the larger mechanism of respiratory expression—emoting functions which are of so much importance in the higher psychic functions of speech behavior—should be included.

This is as far as most authors have gone. I would add:

5. Still further attention should be directed to those coordinating pathways which sweep up visceral components into the thalamus, striatum and cortex for the body as a whole to operate in its emotive synthesis.[23] Diaschisis, here, while as yet unanalyzable to my complete satisfaction, may be considered when the entire respiratory syndrome is reviewed as an aggregate.

6. Finally, it seems not inopportune at least to mention certain metapsychologic points of view in the conceptions of the Super Ego—the Ego and the It as formulated by Freud and the psychanalytic school in their studies of the traumatic neuroses, the conversion phenomena, substitution phenomena, organic psychoses and organic disease itself. It is certain that all these factors can be brought into relief and can contribute some light to this highly complex series of phenomena.

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23. Weinberg, A. A.: Psyche und unwilkürliches Nervensystem, Ztschr. f. d. ges. Neurol. u. Psychiat. **85**:543, 1923; **86**:375, 1923; **93**:421, 1924. Küppers, E.: Ueber den Ursprung und die Bahnen der Willensimpulse, Ztschr. f. d. ges. Neurol. u. Psychiat. **86**:274, 1923. Goldstein, K.: Zur Theorie der Funktion des Nervensystems, Arch. f. Psychiat. **74**:370, 1925; Ueber den Einfluss motorischer Störungen auf die Psyche, Deutsche Ztschr. f. Nervenh. **84**:119, 1924.

It is a commonplace in the clinical material to find structural involvements of the liver, intestines, appendix, pancreas (diabetes) and hypophysis (obesity), etc. These must have their reverberations in the central organ of the Ego, metapsychologically considered. Psychotic splitting is so frequent as to need no further comment. Repetition compulsive phenomena are equally prominent. The entire literature is shot through with the "lazy" summary of "hysteria," i. e., conversion phenomena as viewed psychanalytically; and the hospitals for mental diseases and municipal hospitals are filled with patients who show the picture of a traumatic neurosis, in some of whom the respiratory phenomena, particularly at certain periods, show the characteristic anxiety neurosis formulations of the freudian discipline (Bychowski, Leyser, and others).

While it is recognized that this "classificatory" partitioning of the material is only a logical artefact, yet the scientific method as such is reduced to the utilization of such fictions in order that analysis and synthesis can be brought about for pragmatic purposes in the handling of individual cases. One need not dwell unnecessarily on this old protagorean-socratic series of antitheses between particulars and universals which has been the battling ground of the philosophers from time immemorial.

1. *Peripheral (Muscular) Origin Hypotheses (Fictions).*—From the logical point of view, these are not "theories" as others have termed them. It is doubtful, according to Vaihinger, whether they have even the validity of hypotheses, but it will serve little purpose to split logical hairs of scientific method.

Bériel, and his pupil Hardoin in his thesis, as has been pointed out, elaborated the conception that the tachypnea was a compensatory phenomenon to make up for the micropnea which was conditioned by a (striatal) rigidity affecting the intercostal muscles.

As Turner and Critchley correctly observe, this cannot be true for all cases, since in a number of patients no such parkinsonian rigidity exists in the muscles. My observations, not limited to the two cases reported as paradigms, tend to show that the Bériel-Hardoin observations have considerable validity. Most of the patients I have seen have had a certain grade of this "rigidity," i. e., static tonus—but this increased breathing is not regarded as a reflex phenomenon conditioned solely by the hypertonus; rather the view is held that both the breathing and the tonus have a more unitary conditioning. Thus, the hypothesis is not a "peripheral" one but is more complicated, and thalamic, striatal and pyramidal tract features are involved. What this may be will be discussed in the larger monograph under the general conception of an "ego" defense mechanism (postural attitude) which is conditioned

by a number of inimical somatic offenses, from other organs than the respiratory ones alone. To be more explicit and possibly didactic, I mean that visceral syntheses are interfered with by cortical or mesencephalic cut-outs and energy is diverted to other pathways for expression. The Ego or the Id—metapsychologically expressed—is jeopardized and as Hughlings Jackson showed for aphasia and Hôlles and Ferenczi showed for general paralysis, compensatory utilization of other pathways takes place. If the displacements utilize the symbolic sphere, hallucinations and delusions result. If the somatic sphere is utilized, visceral conversion signs appear. I have for some years speculated as to the dynamics of the changes in the liver in Wilson's disease, in encephalitis and in certain catatonias along these lines.

Turner and Critchley include the diaphragmatic myoclonic movements—really referable to the "tic" types. These myoclonic situations—epidemic hiccup, Dubini's electric diaphragmatic choreas, etc., while manifestly of muscular origin, do not belong here properly.

2. *Thalamic Hypotheses.*—Thalamic involvements are frequent in my experience and register themselves early in the lethargic features of the general encephalitic syndrome. (Certain pharmacologic agents, particularly of the alcoholic series—chloral, barbital, sulphonethylmethane and medinal—have induced deep sleep and at times a marked cessation of the respiratory disturbances. Just what deductions may be drawn still remains for further study.) Direct associations between the respiratory situations and the thalamic implications are undoubtedly present in many cases. Careful consideration of the Head-Holmes studies on thalamic-cortical interrelationships relative to the handling of the afferent impulses from implicated exteroceptors and interoceptors leaves a number of thorny problems to be studied more carefully.

It seems still open to discussion whether the thalamic hypothesis is a main situation as now conceived. It must be left for a special study of how these patients handle the specific inciters of their attacks. Thus, in case 1, certain suggestions have been advanced relative to specific inciter factors as operating to induce or to control the discharge which has been narrowed down to the respiratory apparatus—operating at low ontogenetic levels.

It is maintained here that all movement, whether automatic or voluntary, implies response to stimuli, external or internal, conscious or unconscious; the possibilities, therefore, of thalamic handling or that of its sensory homologs at the same level are not too easily dismissed. Koffka is certainly not correct in his discussions of the impulsive actions of the new-born when he states that the movements observed are not the results of stimuli. Careful perusal of the earlier studies of Gerstmann and Schilder, then those of Forster, Bostroem, Wartenburg,

Cruchet, Wilson, Gamper and Untersteiner, and many others, shows that certain definite behavioristic patterns appear either in pure culture, as it were, or mixed with other patterns. In some instances these patterns have been isolated, following the conceptions of Sherrington, Magnus and others. Wartenburg's studies on athetosis and on torticollis may be cited, while particularly noteworthy are the observations of Gerstmann and Schilder and their confreres, the study of Bostroem, and the case analyzed by Gamper and Untersteiner.[24] Here was a complex group of movements which, briefly indicated, started with a mouth opening, turning of the head toward one side and a series of compensatory torsions to meet the original mouth stimulus. The authors analyze the condition on the basis of a yawning reaction and then pursue it further as a reflex response to an oral stimulus such as occurs in nursing. They show that the whole movement is only an extensive spreading from this original sucking stimulus pattern. They offer no introspective material on this point, as is believed desirable from my point of view, but the purely behavioristic analysis is strongly confirmatory of the one I advocate; i. e., the dissolution of function to earlier levels of action. It is evident in the patient of Gamper and Untersteiner that the initial sensation starting in the mouth undoubtedly reaches the thalamus, and from there on—as with the Head and Holmes series—an exaggerated and diaschitic response is released in the form of an isolated pattern.

It seems probable that the careful scrutiny of the thalamus in microscopic changes, just begun, will be fruitful. Tilney and Casamajor have attempted the analysis of the isolation of these bits of patterned muscular response (automatic associated control) in lower animals by the myelogenetic method, and I consider their work of importance in the field now under revision.

3. *Medullary—Bulbar—Hypothetic Origins.*—In view of the many cases of respiratory death with definite lesions microscopically observable (Goldflam et al.), it is not strange that most observers have looked on the respiratory difficulties in postencephalitic persons as attenuated types of such medullary or bulbar implication. Here two conflicting series of observations stand out. In the one the respiratory difficulties have been developed directly out of or were continuations of the early stage of respiratory phenomena. When the many observations recorded in the historical summary [2] referred to are reread, it will be seen that these were in the minority. On the other hand, the postencephalitic respiratory difficulties have supervened many months after the initial infection. In the acute phases many of these patients have shown no

24. Gamper and Untersteiner: Ueber eine Komplex-gebaute postencephalitische Hyperkinese und ihre möglichen Beziehungen zu dem oralen Einstellautomatismus des Saüglings, Arch. f. Psychiat. **71**:282, 1924.

marked respiratory disturbances. In many, it is true, the interregnum has shown many sniffling, hawking, coughing bridges, as it were, yet the purer types of tachypnea, regular or irregular, have seemed to become consolidated, often many months, in some instances a year or more, after the original difficulty (Krambach, one year; Kennedy, two years; etc.). It is of interest to note that Wimmer in his study follows von Economo [25] and others, and repeatedly calls attention to reinfection or persistence of subinfection to account for the advance in the symptomatology of these postencephalitic cases. While it is believed that there is no definite proof to show that this is not so, and that there is possibly none in its positive favor, my point of view in this paper is that such a conception must be set alongside of or possibly in opposition to the view that "regression of function" through disease is of more significance. Disintegration of function through *relative disuse* is seen everywhere in pathologic changes in man, and it is my intention to emphasize this well-known principle, especially as it calls for a larger therapeutic ingenuity than the more or less fatalistic attitude of progression of a disease process through reinfection. Personal observations repeatedly have shown marked functional regression in the respiratory syndrome, especially during some intercurrent disturbance. Thus the patient in case 2 is markedly worse during a menstrual epoch and also has shown marked regression during an attack of tonsillitis. Note has been made of the breaking out of the respiratory syndrome following tonsillectomy (case 1), and a number of observations have been gathered which tend to show marked regressive behavior disturbances of the schizoid type following tonsillectomy. It can hardly be argued seriously that tonsillectomy constitutes an advance of the infection or a reinfection, but it can be considered legitimately as a regressive factor. Further, to cite only two bits of evidence from many bearing on the increased susceptibility of these encephalitic patients, the studies of Appelroth [26] and Beringer [27] are of interest. The former investigator has shown a marked increase of stimulus reaction on the part of the skin to the roentgen ray. My patients in cases 1 and 2 were highly sensitive to the sun and to heat and cold. Further, the study by Beringer demonstrates that muscular strain may bring about a distinct advance in the postencephalitic syndrome. This line cannot be followed further here, although it merits specific consideration.

In a further review of these medullary hypotheses and of their inadequacy, attention may be called to Turner and Critchley's résumé

25. v. Economo, C.: Ueber den Schlaf, Berlin, Julius Springer, 1925.

26. Appelroth: Strahlentherapie **18**:593, 1924.

27. Beringer: Exacerbations of Epidemic Encephalitis After Exertion, Klin. Wchnschr. **3**:2058 (Nov. 4) 1924.

as well as to Wilson's recent contribution on laughing and crying.[28] The earlier students, Turner and Critchley, for instance, following Wilson, place this respiratory center at various locations in the central nervous system.

The cinematographic reproduction of the respiratory behavior in case 2 will emphasize the participation of the facial musculature. Wilson's discussion of this aspect of respiratory behavior may be quoted in extenso, since it falls in line so neatly with the underlying thesis of this presentation. Wilson writes:

> The physiologic association of facial and respiratory musculatures in the expression of emotion scarcely calls for any comment, so obvious is it. Bell called the seventh the "facial nerve of respiration"; when the lower face (mouth and nose) is paralyzed it was described by him as "paralysis of the respiratory functions of the facial." The implication of the face in sneezing, the facial spasms occurring with respiratory gasps in extremis, the collaboration of the facial apparatus with the other in ordinary breathing and speaking are simple instances of the action of this important synkinesis. The seventh nerve is united functionally with the tenth, and also on occasion with the eleventh and certain upper cervical spinal groups. For simplicity's sake, we may allude to it as the faciorespiratory mechanism. We note that its normal activities are involuntary, i. e., it is under voluntary control only to a limited extent.
>
> The localization of the "noeud" of this mechanism is still uncertain; we have to postulate a center linking the seventh nucleus in the pons with the motor nucleus of the tenth (nucleus ambiguus) in the medulla and the phrenic nuclei in the upper cervical cord, etc. By all analogies this "center" must be supranuclear; for the sake of argument we may suppose it has an upper pontine site.
>
> Our second preliminary consideration is to bear in mind the existence and function of the respiratory centers proper for ordinary automatic breathing, situated in the medulla. With normal action must also be associated cooperation on the part of the larynx and the face, otherwise normal breathing might partake of the noisy character observed in various diseased conditions.
>
> The most recent work on the localization of the respiratory centers is that of Lumsden, who has shown, by numerous experiments on cats, rabbits, dogs and monkeys, the somewhat elaborate nature of the arrangements. Thus, he has demonstrated that ordinary rhythmic respiration—quiet, unconscious breathing—depends on several factors. There is (*a*) an inspiratory mechanism at the level of the striae acousticae; this he calls the "apneustic center," because when this group of nerve cells is cut off from above, prolonged tonic contraction of the inspiratory muscles ensues ("apeusis"). The level of the striae acousticae is upper medullary. (*b*) Just below this there is a separate expiratory center (medullary), the existence of which has long been suspected and is now apparently established. (*c*) Both (*a*) and (*b*) are controlled by a higher center in the upper half of the pons, styled by Lumsden the "pneumotaxic" center, because it regulated normal quiet breathing. When it is cut off from (*a*) by appropriate

28. Wilson, S. A. K.: Pathologic Laughing and Crying, J. Neurol. & Psychopath. **4**:299 (Feb.) 1924; Some Disorders of Motility and of Muscle Tone, with Special Reference to the Corpus Striatum, The Croonian Lectures, Lancet **2**:1 (July 4), 53 (July 11), 169 (July 25), 215 (Aug. 1), 268 (Aug. 8) 1925.

section, respiration takes the form of a series of prolonged inspirations, each followed by two or three relatively quick respirations of abnormal type. Lumsden has shown that this cycle repeats itself with great regularity. Evidently, then, the pneumotaxic center produces normal respiration by inhibiting the activity of the apneustic center below (behind) it. (*d*) A fourth, "gasping" center, situated below (*b*) at the level of the apex of the calamus scriptorius, is regarded by Lumsden as a "relic," and need not further concern us.

Our next consideration bears on the influence of voluntary action on the respiratory center in the pontomedullary apparatus. Its automatic activity is set aside voluntarily when we deliberately hold our breath, or when we voluntarily pant, cough, yawn, sigh, take deep breaths, etc. Further, its activity is set aside involuntarily when we are convulsed with laughter, or when we give way to crying, sobbing, howling. Both in the former and the latter case facial movement is involved; we innervate the facial musculature voluntarily for the purposes specified, and the face takes its share in the involuntary expression of joy or sorrow.

Thus we get the idea of a double control over the faciorespiratory synkinesis: (*a*) a voluntary control when we choose to inhibit automatic movement, and (*b*) an involuntary control when that automatic movement is forced to give way to the expression of emotion.

1. *Voluntary Control.*—The path followed by volitional impulses to facial and respiratory muscles is undoubtedly the familiar corticopontine, corticobulbar, and corticospinal tract. In particular, the geniculate bundle of the pyramidal tract, from the operculum and lower end of the precentral gyrus, via the genu of the internal capsule, conveys these impulses to the appropriate nuclei. As we have seen, voluntary breathing sets aside ordinary breathing; hence, we must postulate, on the principle of reciprocal innervation, a synchronous inhibition of the automatic pontobulbar center. The anatomic course taken by the latter, inhibitory, impulses is less certain, but of their reality there can be no question. It will be remembered that Hughlings Jackson explained the interesting observation he made on respiratory movement in hemiplegia by the existence of double sets of respiratory fibers passing from the brain in this way.

Lesions, therefore, of the geniculate bundle anywhere in its course, especially if they are bilateral, will impair volitional control over the musculatures concerned in the expression of emotion, with the result that the involuntary action of the same mechanisms will tend to become abnormal. Pseudobulbar paralysis is the disease of the geniculate bundles which, we have already seen, is particularly prone to be accompanied by the phenomena of rire et pleurer spasmodiques.

It is clear, then, that the more absolute the cardiorespiratory paralysis, the more exaggerated is the involuntary innervation of the same mechanism. In this connection Monrad-Krohn has shown that the emotional innervation is often distinctly exaggerated on the paretic side in hemiplegia, and has proved (by the "slow-motion" cinematographic camera) that emotional movement is actually quicker on the side showing voluntary paresis. On the other hand, for the exhibition of "uncontrollable" laughter or tears a degree of volitional paresis or paralysis is not quite essential, though it is certainly usual; the involuntary action of a normal laugh may break down normal control; the quivering lip of the child is indicative of a balance between the action of the voluntary and the involuntary processes which may be tipped over in either direction by a trifle.

2. *Involuntary Control.*—The careful experiments of W. G. Spencer, in 1894, determined the existence of four paths from the cerebral cortex to the respiratory mechanism. Of these, one is undoubtedly the voluntary path just mentioned, from the motor cortex via the genu of the capsule; its stimulation produces, in the ape,

a sort of "holding the breath" or, as Spencer calls it, "overinspiratory tonus." Two of the other tracts follow an entirely different course; one is an "arresting" and the other an "accelerating" path. The former arises from the under surface of the frontal lobe, the latter from the sensory cortex. Spencer has traced the two throughout their course; they come together toward the middle line at the mesial aspect of the lower optic thalamus, bordering on the third ventricle, and run down, near the midline of the tegmentum, to the medulla. Both are far removed from the voluntary tract for respiratory innervation in the capsule and crus. More exactly, the route followed by the arresting path is from a spot on the under surface of the frontal lobe where the olfactory tract runs into the temporosphenoidal lobe, along the "olfactory limb" of the anterior commissure (where it decussates), by the side of the infundibulum, past the nucleus ruber below and external to the aqueduct in the plane of exit of the third nerve, and so to the medulla. As for acceleration, "commencing especially from a point on the convex surface of the cortex within the sensorimotor area, the effect may be followed back through the lenticular nucleus where it borders on the outer and ventral portion of the internal capsule; the strand runs at first externally and then ventrally to the motor portion of the internal capsule, and so reaches the tegmentum. The lines from the two sides meet in the interpeduncular gray matter at the level of and just behind the plane of the third nerves."

I believe it is a feasible speculation that these are the paths for emotional activation of the faciorespiratory mechanism. They are separate from the paths for voluntary control; they come toward the midline in the regio subthalamica and tegmentum; stimulation of them produces unvaryingly the phenomena of arrest and acceleration noted above. As far as the respiratory element in involuntary laughing and crying is concerned, their appropriate excitation and inhibition will explain the mainly expiratory character of the former and the mainly inspiratory character of the latter.

Our general conclusion may be couched in the following terms: There are corticofugal paths to the faciorespiratory centers in the pons and medulla that are independent of the voluntary corticopontobulbar tracts to the same nuclei; on excitation they will either arrest or accelerate, i. e., interfere with, the normal rhythmic activity of the respiratory center; the available evidence warrants the speculation that they are the routes taken by emotional impulses to modify the faciorespiratory synkinesis in the direction either of laughter or the reverse. Their exact course remains for further substantiation; it is perhaps noteworthy that they make their way separately toward the midline, skirting the lower optic thalamus (in the case of one) and passing by the lower regio subthalamica to the tegmentum, and so to more caudal levels of the neuraxis.

For myself I am of the opinion there is more to be said for the participation of the cortex in the production of abnormal emotional activity. We cannot take it that the cortical origins of the arresting and accelerating respiratory tracts of Spencera are physiologically, though anatomically, separate, and we may ask—using Mills' expression—where is the rendezvous? In an ingeniously developed argument, that veteran neurologist contends that in the right hemisphere, mainly, in the midfrontal region, are centers for the representation of movements especially concerned with the expression of emotion. He gives the term "movement" a broad significance, as applying both to skeletal and to visceral, vascular and secretory activity. On the other hand, Bianchi, whose claim to speak with authority also is acknowledged, declares that "to maintain that the frontal lobe plays a part in the essence and mechanism of the emotions . . . is a bold hypothesis in which there is a good deal of mere conjecture and certainly no basis of proof."

Be all this as it may, and however much in the matter is still obscure, our facts have led us to suggest that there are corticofugal paths for the expression of the emotions via the faciorespiratory apparatus, distinct from those for voluntary innervation of the same nuclei, and as necessary corollary we presume the existence of a cortical nodal point coordinating them. Its situation is at present indeterminate, yet it is likely to have some definite position. In this connection I echo with approval the works of Mills, who declares he is not one of those who believe that the problem of emotion, or of any other great mental process, is to be explained by regarding it in some vague way as a complex expression of the action of the cerebral cortex as a whole.

There is clinicopathologic and experimental evidence suggesting that nonvolitional control over the normal activity of the faciorespiratory mechanism is exercised from the cortex by routes that pass separately downward to come together toward the midline in the regio subthalamica and tegmentum.

It is not certain that these actually pass through the thalamus in man, though it is understandable that some thalamic lesions may be so placed in that ganglion as to interfere with them as a vicinity effect.

We have no information as yet to show these paths are interrupted by a thalamic relay, nor is it known that emotional impulses can pass from sensory to motor side at this level; it is possible, perhaps, but not probable.

As practically every observer has called attention to the fact that under certain situations of attention distraction this breathing behavior is entirely overcome and that under certain emotional stimuli it may be made worse, and, further, that as in practically all cases the disordered breathing behavior ceases during sleep, it is fairly certain that bulbar implications alone do not offer a complete answer looking toward an elucidation of the syndromes under consideration.

When one reflects for a moment on the phyletic history of the gradual neural integration of speech into the respiratory mechanism and ontogenetically studies respiratory behavior from the initial cry of the child at birth through its evolution into the dynamic utilization of speech symbols as expressive of its life's patterns and purposeful actions, it seems evident that a purely medullary mechanistic blocking is entirely inadequate to explain the situation. As Turner and Critchley have emphasized and Wilson and others have indicated, higher cortical pathways not only of value for respiration per se must be studied, but also the respiratory syndrome must be viewed in the light of its purposeful symbolic and its known emotive functions.

It will be apparent to all students of the problems of behavior disorders in encephalitis that an enormous terrain is entered. The lines of inquiry spread out in every direction. They become pluridimensional and almost infinite.

As the more astute as well as the more superficial students have called attention to the "emotional" situation, the latter being satisfied with the word hysteria, the former not satisfied with an etymologic interpretation but insistent on deeper correlations between structure and

function—as shown by Vogt's suggestions in the "Heidelberg" paper as to the subtle relations of so-called "hysteria" to striatal pathologic changes—a sketch of the following out of a few lines may not be without value.

I once observed an interesting respiratory syndrome in a pharmacist, aged 23. He came to the Post Graduate Hospital Medical College Clinic "barking like a dog." His bark was a dramatic performance, which had developed over a period of two or three years. Nothing short of a phonograph record could portray the sounds he emitted. They appeared in episodes lasting from five to thirty minutes.

Conceiving the possibility that this was a condensation, I inquired whether the sounds previously had been as they were at the time observed. They had been more elaborate but still phonetically unrecognizable. When the history was pushed a step further backward, a phonetic semblance to recognized vocables became apparent, and when it was pushed still further it was plain that he was saying—a year earlier, half aloud and half to himself—"No I won't, no I won't, no I won't" and then, further back, the actual conscious formula appeared: "No I won't masturbate." Thus, in the space of a year and a half or more, an original "no I won't masturbate" became by gradual condensation the "dog-like bark" heard in the clinic. Naturally this was not all learned in an hour, nor in less than a dozen hours of careful and detailed study, not only of conscious but also of unconscious material.

This observation might not seem pertinent, but those interested need only read Runge's detailed report [18] of a respiratory encephalitic syndrome, which he studied by the hypnotic method, to see that he came to the conclusion that the respiratory behavior was a representation of what he termed a "larvated masturbation."

I believe Runge is correct, but I think that further investigation would show it was more than that, as psychanalytic study in both cases here presented shows that the "masturbatory" complex is only a part of the respiratory syndrome. The report [5] of case 1 gives some of the evidence showing that such a displacement from the genital to the respiratory area was present. Similar mechanisms are equally prominent in case 2. Witzl's short analytic material is also of interest in this connection.

To follow out another line not so well known in contemporary psychiatric literature but almost a commonplace in psychanalytic literature, the occurrence of "obscene language" as a displacement mechanism from "anal eroticism" will only be touched on here. Abraham, Ferenczi, Jones and others have analyzed the situation in full. In case 1, the patient in the earlier history was exceedingly profane and obscene (Burr [6] comments concerning "degeneracy" in this case). Scores of reports are available concerning this obscene language behavior in the psychotic reactions of the encephalitic patient, particularly in the schizoid types, in which the analogies to schizophrenic obscenities are obvious. Many of the nose grimaces seen and sundry obscene words

heard in case 1 were loosened bits of early anal-erotic functioning pried apart from an integrated personality by the encephalitic process, and through diaschisis came into conscious expression, passing the broken down super ego (censor) mechanism, probably through cortical blocking from some structural substratum. As recovery took place it was evident that the blocking was partial and not global, and resynthesis of the so-called "normal" personality emerged. Thus, later, when well, the patient could utilize a symbol of "smearing" an enemy in much the sense it would be used on the football field when the opponents' attack was "smeared," without recourse to a less elegant form of expression which alone was available to him when his higher pathways were functionally difficult to travel. The frequent "nose blocking" in this and other cases was plainly referable to "smell" and to "anal eroticism."

Although this study does not concern itself with the polyuria so frequently observed in the larger group of the encephalitic syndromes, a few cases of a "whistling," "hissing" respiratory type of so-called "tic" were plainly traceable to the urethralerotic type of diaschitic phenomena. One patient clearly showed that "whistling" and the wish to urinate were correlated. There was a distinct proportion which could be stated "the more he whistled, the less he urinated, and the less he could whistle, the more the urge to urinate."

Finally, it seems that with reference to the type of behavior noted in case 2, to which I have drawn special attention, a certain reemphasis is permitted which implicates thalamic pathogeny. As already suggested, the presence of thalamic overresponse to the multiform stimuli of the environment offers a definite insight into this patient's behavior. To use a slang expression, she had to handle her entire traffic by a single line after the impulses left the thalamus. Here was a definite thalamoneocortical diaschitic situation (Küppers et al.). What remains to be explained, however, is the periodicity factor found in so many of these patients. Why can they "handle the traffic" satisfactorily for so many minutes or hours, and then suddenly get in a jam when the one line open is the oldest of all the vital lines, i. e., the respiratory one? I am convinced that analytic study of the personality by the analytic method will show wherein the spiritual synthesis, or "morale," using the word in its largest social sense, has been below par in its evolutional capacity, either determined by gene or educational factors; and hence, when a break-down of the organization of the entire neural mechanism takes place, regression to those firmly organized pathways will result. This could all be better expressed, in my opinion, in the metapsychologic terms of Freud, but this is reserved for another occasion.

As Jackson says concerning an aphasic patient, he speaks badly with the part of brain that is left, i. e., negatively, there is a falling out of certain components in speech functions, and positively, imperfect use

of what is conserved. In the same manner it may be said that the person with respiratory encephalitis breathes badly with the part of the brain that is functioning. In a negative sense, higher arc expression components fall out—temporarily or permanently—and positively, faulty modes of expression occur through the mechanism remaining.

Thus, one can say that it is less the respiratory mechanism per se that is at fault, even though behavioristically most prominent, than what is compelled to function for it as a substitute, but behavioristically unexpressed.

DISCUSSION

DR. SIDNEY I. SCHWAB, St. Louis: Did the patient talk during these atttacks?

DR. JELLIFFE: Yes. She would stop for two or three minutes and talk intelligently.

DR. SCHWAB: Then she has one other form of expression. I understood you to say there was only one.

DR. JELLIFFE: In a general sense, yes. Even speech utilizes a respiratory pathway. Everything had to go out through that pathway, of course. She does eat and play the piano and she listens to the radio, but the chief pathway she utilizes is a respiratory one.

DR. MORTON PRINCE, Boston: Did the emotions find expression by alterations?

DR. JELLIFFE: The patient cried a great deal. When she could not urinate she cried.

DR. PRINCE: Were the emotions expressed at all through the breathing?

DR. JELLIFFE: That is a complex question, and I purposely avoided considering it, because one would have to go into the psychanalytic situation. By this method one learns of a mass of material that is coming out through the respiration. Masturbatory wishes, coitus equivalents and a host of other types of social activity are being expressed in this way. Such material, however, is obtained by other methods of study. I have limited this presentation more particularly to what in my opinion one could localize as defective structural foundation of the situation.

DR. FOSTER KENNEDY, New York: I was interested in what Dr. Jelliffe said as to the agony that these patients experienced. I have been surprised at the lack of agony. Patients who pant as though they were utterly blown have none of the sensations, apparently, of respiratory distress. I was particularly interested in a patient because he had a great deal of personality and emotional change. He became cyanotic after he had had respiratory tachypnea for twenty minutes. The act of breathing did not hurt him for the first ten or fifteen minutes of the crisis.

DR. JELLIFFE: With reference to the agony, perhaps I emphasized the situation unduly for this particular case. I think Dr. Kennedy is right, because I think I said, or I would have said if I had read my paper, that an innumerable series of levels present themselves in these patients, and that the degree of metabolic involvement in a sense can be used as a measure of the grade of the pathologic lesion that I am emphasizing.

In some of these patients, water, salt metabolism, and a series of metabolic anomalies are present; changes in the sugar content, etc., indicative particularly

of the involvement of the vegetative centers of which I have spoken. In others, the involvement is much less; the metabolic anomalies are less; the agony is less; hence the discomfort is less. So that mild expressions, such as the type to which Weir Mitchell made an interesting contribution back in 1880, may be found. An encephalitic case was probably described as hysteria, and the literature is shot through with the diagnosis of hysteria in these encephalitic cases. The same situation presents itself for the neuroses and psychoneuroses. Metapsychologic considerations I have left aside, although to my mind they constitute the most important part of the whole contribution that I have to offer; namely, that as one does get some dissociation between certain of the thalamic end stations and the neo-encephalon, he has an interesting contribution to psychopathology in its most intrinsic sense, in that the individual is reduced to lower levels of psychopathologic or psychopathic personalities in which all of the behavioristic anomalies, which I have not discussed at all, come up. In my mind this offers an important situation wherein the so-called "organicist" and "functionalist" can really shake hands and dance around the May-pole together.

Dr. Michael Osnato, New York: What part did the alkalosis induced by the hyperpnea play in the attack, and was anything done to determine the presence or absence of alkalosis? The picture drawn seems to me to be typical of those which may be induced by deep and rapid breathing.

Dr. Jelliffe: Hydrogen ion concentration determinations were made in both cases. The calcium defect was minimal in both cases, not sufficient to get to the grade of the ordinary alkalosis that is found in the hyperpneas, per se. This subject has been pursued with a great deal of interest because it is bound up with that of reflex hyperexcitability in which the impulses pass over the synaptic junctions by reason of a relative calcium reduction, offering another reason why incoming stimuli are not sifted out sufficiently well at the synaptic barrier. Consequently, the patient is swept away by his thalamic over-response, and the super-ego, man's latest series of check processes, does not have a chance to function.

Dr. Lewis J. Pollock, Chicago: It may be of interest to know in this connection that in the course of some experimental work on convulsions it was found that picrotoxin constantly produced a hyperpnea. When the animal was decerebrated the respiratory rhythm became normal, indicating the existence of a secondary respiratory center, probably in the superior colliculi.

Dr. M. Allen Starr, New York: I have seen two cases that are of extreme interest to me, and I would like to know whether the same thing has been observed by others. One was a case of true postencephalitis after two years. The other was a case of chronic paralysis agitans. As the two were parallel and afforded a syndrome that I had never seen in either, I should like to know whether they have been observed by others.

In my cases there have been spasms of the throat, impeding the act of swallowing and leading to great choking, and these choking fits go on until the patients are blue in the face and seem to lapse, in both cases, almost into a state of unconsciousness; they are attended with great distress of mind. Then the fits suddenly are terminated as the dyspneas pass off.

Dr. Jelliffe: Symptoms similar to those observed by Dr. Starr have been described and classified by Gabrielle Lévy in her thesis on postencephalitic syndromes as hawking, coughing, choking and sniffing tics of various kinds. Professor Wimmer in his book on postencephalitis has given some descriptions of them as well, and I think his discussion is perhaps one of the most illuminating of all.

Runge had a case in which the patient choked in the attacks and then went on to voluntary choking of himself; i. e., tried to choke himself to death. I think it is important to call attention to one psychologic fact, that a part of the function of the apnea in these cases is a wish to die. In other words, it is a suicidal wish. This apneic phase, the holding of the breath, is interesting; Runge's case bears on it distinctly, because he describes a young theological student who was filled with ideas of sin, just as this patient of mine, and he tried definitely to choke himself with his hands. Others have thrown themselves on the floor and under benches and precipitated themselves from heights and hurt themselves in various ways. Of course actual suicides are known as well.

The paralysis agitans cases also are well known. It is becoming increasingly important. Lévy, in a recent discussion of the whole situation has called renewed importance to the fact that many multiple sclerosis syndromes are developing from this situation. A number of other syndromes which have been of a great deal of curiosity in the past are now becoming household pets.

DR. STARR: Are these attacks ever fatal?

DR. JELLIFFE: The choking attacks have been.

DR. STARR: Or the dyspnea?

DR. JELLIFFE: Yes. Goldflam has described some and has given us the pathologic pictures in detail as to the involvement of the respiratory nucleus.

THE RÔLE OF SYPHILIS IN THE PARKINSONIAN SYNDROME*

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From the time of the original description of the shaking palsy by James Parkinson [1] up to the epidemic of encephalitis in 1918, paralysis agitans appeared to fall into two groups, the juvenile and the senile. The latter group was subject to some variation as to age, but its chronicity made the largest number of patients fall definitely in the later decades of life. Some of the early writers were struggling to probe further into the problem of its etiology, and in the pre-Wassermann days its concurrence with syphilis was noted. Eshner [2] concluded that there is little connection etiologically between paralysis agitans and locomotor ataxia. Wassermann tests and examinations of the spinal fluid were not made in his cases, but he cites a case of tabes in which six months later a parkinsonian syndrome developed, the patient dying two years later of a cerebral hemorrhage. He cites eleven patients between the ages of 52 and 65 in whom this coincidence was found. In the light of present knowledge, however, the facts are unreliable. Oettinger [3] noted five patients, with an average age of 55, with syphilis and an associated parkinsonian syndrome. The diagnoses in these cases were made on indefinite grounds, such as a history of syphilitic infection, scars of a syphilitic lesion of the skin, etc. In three of these cases a negative blood Wassermann reaction was found, and in four other cases cited with pigmented scars a positive diagnosis of syphilis was not made, nor were any associated neurosyphilitic signs mentioned. Oppenheim,[4] in 1912, stated that in seven of his cases there had been syphilitic infection, and in three the disease had appeared at an early age; however, antisyphilitic treatment had no effect on the patients' progress. The literature, as quoted by Camp,[5] in 1888, contains, according to Placzek, a case report by Heineman in which tabes dorsalis and paralysis agitans occurred in the same patient. He reported a second case in 1892, with the typical syndrome and tabes. In 1898, Weil, and in 1900, Hess and

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1. Parkinson, James: Essay on the Shaking Palsy, 1817; reprinted with bibliographic note by Ostheimer, A. J.: Arch. Neurol. & Psychiat. **7**:681 (June) 1922.
2. Eshner, A. A.: Am. J. M. Sc., November, 1909.
3. Oettinger, B.: Med. Rec. **98**:15, 1920.
4. Oppenheim: Text-Book of Nervous Diseases, 1912, p. 1299.
5. Camp, C. D.: J. Nerv. & Ment. Dis. **41**:489, 1914.

Wertheim-Salamonsen reported this coincidence in a patient having general paralysis. J. H. W. Rhein, in 1902, reported a tabetic patient with paralysis agitans tremor. Additional cases have been reported by Koddeman, Penzolodt and Sturtzing, Bychowski, L. Burns, Eichorst, and Kurt Mendel. All of these, however, were merely casual clinical observations and are of no value for the present study.

Prior to 1915, the juvenile type of paralysis agitans was considered pathologically to be an abiotrophy, and the senile type a vascular degenerative process. With the epidemic of encephalitis, however, an entirely new concept of the disease was elaborated, so that now one must reorganize the older conceptions and fall back not on a symptom-complex as the disease entity, but classify paralysis agitans as a type of the parkinsonian syndrome.

Encephalitis, as a stimulus to neurologic diagnosis, has not had an equal since the introduction of the spinal fluid Wassermann test, and it is possible, in retrospect, to separate the striate-pallidal syndrome occurring in it into the acute and the chronic progressive types. I need not comment here on the extreme complexity and frequency of the variations in this striatal syndrome which have been reported, nor do I plan to touch on the anatomic lesions responsible for these variations. The well known clinical picture of rigidity, loss of associated movements, tremor, and associated phenomena is so outstanding a syndrome as to dominate all other striatal sequelae in this disease. On the basis of this newer conception, a fresh impetus has been added for study of the etiology of the parkinsonian syndrome, and the present contribution will, I hope, more definitely place the rôle of syphilis as a possible cause for a lesion in the corpus striatum.

The variability, multiplicity, and extent of invasion of the central nervous system by syphilis do not have an equal, except perhaps in the virus of encephalitis. The two diseases, however, act on the nerve tissue in a different manner. *Spirochaeta pallida* invades the nerve tissue in a slow, chronic destructive process (such acute nervous lesions as do occur are rare and of lesser importance). These lesions are more apt to affect the motor elements of the brain (cortex, cranial nerves, etc.), with an initial involvement that may be sudden, and then a slowly progressive degeneration of the surrounding nerve structures results. The clinical syndromes seen are therefore insidious in onset and are recognized only when destruction of a functional nerve element has occurred. Thereupon ensues a further slow progression of the clinical symptoms until treatment is instituted.

Encephalitis, on the contrary, is an acute infectious disease affecting the nerve tissue largely through perivascular inflammation, destroying the surrounding areas suddenly and violently. The particular elements involved by this disease appear to be the sensory structures, though this

is subject also to considerable variation. The irritative and destructive process during the febrile period is responsible for a series of symptoms of an acute type. Following this is a gradual improvement as the inflammatory process subsides, to be followed at a more or less considerably later date by signs attributable to either a subacute or chronic recurring process or a degenerative one. It is therefore of considerable importance to determine whether the particular parkinsonian syndrome fits into one or both of the groups mentioned.

The literature on the subject shows many observations of considerable interest during the past few years, including those in which syphilis and encephalitis coexist, and those in which no history of the latter is obtained. By far the largest group quoted in the literature is that in which a parkinsonian syndrome, caused by either encephalitis or arteriosclerosis, supervened on a syphilitic infection which may or may not have involved the central nervous system. Lafora,[6] in a brief report, cites two cases in which a purely extrapyramidal syndrome appeared on the basis of juvenile syphilis. This, he thinks, is caused by a vascular process in the corpus striatum. A case is reported by Babonneix and Pollet[7] in which a typical parkinsonian disease was seen in a syphilitic man, aged 47. The contrast between the strongly positive blood Wassermann reaction and the completely normal cerebrospinal fluid indicated to him that the coexisting parkinsonian syndrome was of nonsyphilitic origin. Covisa and Bejarno[8] describe three patients, all of whom had had syphilis and had suffered from influenza, and remark that previous infection by influenza or encephalitis may occasionally favor the fixation of the syphilitic toxin in the nuclei at the base of the brain. None of these three cases showed pupillary or reflex changes and only one gave a faintly positive spinal fluid test; all are characteristic of the first group.

Schaeffer and Boulanger-Pilet[9] report a similar case: a postencephalitic parkinsonism supervening in the course of syphilis. They note that "two equally neurotropic viruses existed together in this patient, the action of which it is precarious to dissociate." A discussion of this paper by Massary brought forth the report of another case which differed only in that there was an associated syphilitic dermatosis and a positive Wassermann reaction with the spinal fluid as well as with the blood. Gibson[10] cites a patient, aged 42, with a history of a penile sore, a nervous breakdown and, later, influenza, who developed a typical parkinsonian attitude with dribbling of saliva. The pupils were unequal and

6. Lafora, G. B.: Arch. de neurobiol. **3**:252, 1922.

7. Babonneix, L., and Pollet: Bull. et mém. Soc. méd. d. hôp de Paris **49**: 1340, 1925; abstr. in J. A. M. A. **85**:1921 (Dec. 12) 1925.

8. Covisa, J. S., and Bejarno, J.: Acta. dermo sifiloge **16**:59, 1924.

9. Schaeffer, H., and Boulanger-Pilet, G.: Rev. neurol. **38**:1365, 1922.

10. Gibson, E. T.: M. Clin. N. Amer. **7**:1303, 1924.

sluggish to light and accommodation, and the tendon reflexes were absent. The spinal fluid showed a ++++ Wassermann reaction, and a tabetic colloidal gold curve. Unquestionably, this patient presented a postencephalitic parkinsonism engrafted on an old tabes dorsalis.

The following case history from my own records is characteristic of this group:

CASE 1.—M. G., aged 36, a produce dealer, was referred by Dr. Edward Ill, Newark, N. J., complaining of general incoordination and weakness. He had had sleeping sickness in January, 1925, with drowsiness and diplopia, and had been in bed for three weeks. Six months later he noticed difficulty in talking, was always tired, and the arms were stiff. This progressed up to the time of admission. He had been impotent for four months. There was no history of infection with syphilis; he had gonorrhea in 1911. He has one child, and his wife has not had any abortions or still-births. The wife's brother died from general paralysis; the wife's Wassermann reaction is now negative.

Physical examination revealed masked facies and a general flexed attitude with a slight stoop. The arms were held stiffly at the sides with absence of associated movements. The speech was monotonous with a jerky quality. Tremor of the hands was not present but a tremor of the face and tongue was observed and there was considerable salivation. The biceps reflexes were present; all other reflexes were absent. The pupils were dilated and irregular and were fixed to light and in accommodation. The fundi did not show any change. There were no other cranial nerve disorders.

The laboratory data, except for the serologic tests, are not important. The Wassermann test, with a crude acetone-insoluble antigen, was +; with a cholesterinized antigen, it was ++. The spinal fluid did not show any cells; the globulin test was negative; the Wassermann test was ++++ with 2 cc., ++++ with 1 cc., and ++ with 0.4 cc.

The next group of cases reported in the literature are those in which a history of influenza or encephalitis is not obtained but in which a parkinsonian syndrome is present. Two subgroups appear: (1) cases in which the diagnosis is confirmed by pathologic changes observed on postmortem examination; (2) cases in which the diagnosis is made by associated neurologic signs combined with positive serologic tests.

As illustrative of the first of these subgroups, Lhermitte and Cornil [11] have presented an interesting pair of cases that they describe as a "parkinsonian syndrome of the aged." One case was of the type of senile parkinsonism and the other of the pseudobulbar type with muscular rigidity. Changes were found in the pallidal cells of Ramsay Hunt and in the caudate nucleus in the first case, while the second showed the presence of a localized encephalitis of syphilitic origin in the pallidum and striatum.

Mella and Katz [12] report a patient, aged 46, with parkinsonian syndrome, and with unequal immobile pupils reacting, however, in accommodation. The arm reflexes were present; the knee

11. Lhermitte, J., and Cornil, L.: Presse méd. **30**:289, 1922.
12. Mella, H., and Katz, S. E.: J. Nerv. & Ment. Dis. **59**:225, 1924.

and ankle jerks were absent. The patient was mentally dull, had delusions and was depressed. There was a positive blood Wassermann reaction and a negative spinal fluid Wassermann reaction, with 52 cells. Microscopic examination of the brain showed perivascular infiltration with round cells and rod cells in the pallidum, suggestive of syphilis, and also degeneration of the nerve cells. There was a chronic leptomeningitis with atrophy of the frontal lobe. These symptoms were definitely syphilitic, though further pathologic research is necessary to confirm it. Pette [13] reports the case of a man, aged 57, with a severe parkinsonism, who died; the histologic examination confirmed the clinical suspicion of meningeal syphilis and syphilitic disease of the basal ganglia. The gross changes of the vascular system and the presence of gummas in some localities, with giant cell formation, in addition to the positive reaction of the blood and cerebrospinal fluid, left no doubt as to a syphilitic condition of the vessels. Pette says that this case furnishes anatomic proof of the assumption that syphilis is capable of producing the parkinsonian syndrome.

The second of these subgroups is the series of cases I wish to emphasize, namely, those in which the presence of neurosyphilis expresses itself in a definite extrapyramidal syndrome. The early (1914) case report of Camp,[5] though before the "encephalitic era," is undoubtedly of this type. A man, aged 53, with a gradual onset of tremor, pain in the legs, paresthesias, etc., showed a typical parkinsonian syndrome, with the right pupil larger than the left, of the Argyll Robertson type; the arm reflexes were present; the knee and ankle reflexes were absent; the Romberg sign was present; there were 130 cells in the spinal fluid, and a ++++ Wassermann reaction with the blood and spinal fluid. Camp says that any lesion in the central nervous system causing a parkinsonian syndrome is likely to be irritative rather than destructive.

Boas [14] cites a case showing parkinsonism and pyramidal signs on the right side, indicating multiple foci involving the striopallidal and left pyramidal tracts. The blood and spinal fluid Wassermann reactions were positive. The author maintained that the pallidostriate syndrome not only may occur as a sequel of metasyphilis, but also may represent an occasional concomitant phenomenon of all stages of syphilis.

Pette [13] has reported also a case showing a sudden onset of the parkinsonian syndrome on the left side; this progressed rapidly, and there was a history of a syphilitic infection, with ++++ blood Wassermann and positive spinal fluid Wassermann reaction. Without a doubt, a syphilitic vascular accident precipitated the signs in this case.

A personal communication from Dr. G. H. Hyslop allows me to quote a case identical with that of Pette in which thrombosis in a syphil-

13. Pette, H.: Deutsche Ztschr. f. Nervenh. **77**:256, 1923.
14. Boas, H.: Arch. f. Psychiat. u. Nervenh. **66**:662, 1924.

itic endarteritis resulted in a parkinsonian syndrome in a neurosyphilitic patient.

Bejarano y Gay [15] observed two cases at his syphilis clinic: one patient, aged 30, with syphilis of eight years' duration, and the other, aged 33, in whom the striate pallidal syndrome had originated two months previously. Both patients had a positive Wassermann reaction in the blood and spinal fluid with a characteristic colloidal gold curve. Treatment resulted in some improvement. S. A. K. Wilson and Stanley Cobb have also reported a series of cases in which syphilis had involved the mesencephalon.

To this group I will add two cases. I saw the first patient about four years ago. He was a Chinaman, in the thirties, with a parkinsonian syndrome. In addition, there were pupillary changes and positive serologic observations in both blood and spinal fluid. Owing to the fact that the records are inaccessible at present, this brief report is given from memory. Details of the second case are:

CASE 2.—*History.*—G. W., aged 37, a laborer, was admitted to the Neurological Clinic at St. Luke's Hospital, in February, 1925, complaining of pain in the legs and slowness of movements. The onset was gradual, in the spring of 1924, with slight pain in the legs of darting type, which had been worse during the preceding six months. There had been also an increasing stiffness of the legs, tremor of the hands and some change in the facial expression. Paresthesia was not noted. Words had looked blurred at times, but there had been only a transitory diplopia, in February, 1925, which had not recurred. The man was married, and his wife had had three miscarriages. He had a chancre in 1913, which was inadequately treated. His mother had died of a "stroke" at 62.

Examination.—The man stooped slightly. Movements were slow and rigid, with increased tonus, and associated movements were much diminished. There was no ataxia. Tremor was present in the eyelids, and to a less extent in the hands, the latter appearing mostly at rest. The facies was somewhat masked. The reflexes were present throughout, with some hyperactivity of knee reflexes. Plantar extension was not present. The left pupil was larger than the right; they were both irregular in shape; the left reacted actively, the right sluggishly to light. Speech was monotonous. The blood pressure was 180 systolic, and 100 diastolic.

Laboratory examination showed a normal blood count; the urine was normal; the Wassermann test of the blood was ++++. The spinal fluid, Feb. 14, 1925, showed 15 cells; the globulin reaction was ++; the Wassermann test, ++++; the colloidal gold curve was 0.5 1 1.5 2 2.5 2.5 2 1.5 1 0. On March 2, 1925, the spinal fluid showed 2 cells; the globulin was ++; the Wassermann reaction, ++++, and the colloidal gold curve 1 1.5 2.5 3 2 1.5 1 0 0.

COMMENT

The frequent, scattered reports through the literature and my observations and those of many others on the concurrence of the parkinsonian attitude, facies, tremor, etc., in association with general paralysis

15. Bejarano y Gay: Rev. españ. de urol. y dermat. **28**:80, 1926.

should be noted. Gibson,[10] for example, reports a patient with signs of tabes dorsalis, a masked face, pill-rolling tremor, and absence of automatic associated movements in the right arm. There was a ++++ Wassermann reaction with the blood and the spinal fluid; the latter contained 19 cells and gave positive globulin tests. The patient's condition terminated in an expansive type of psychosis, undoubtedly a tabetic type of general paralysis. Wigton[16] also mentions that the masked face and typical tremor may be found several months before dementia can be demonstrated. Diagnosis may be made from signs of neurosyphilis, serologic tests and the gold curve of general paralysis.

Christian[17] reports the pathologic examination of 162 cases of general paralysis, 2 per cent of which showed softening of the lenticular nucleus close to the posterior rim of the internal capsule. Softening of both caudate nuclei was found also in 2 per cent, and one case showed a softening of the right lenticular nucleus and double optic atrophy.

It therefore seems definitely established that the extrapyramidal syndrome is frequently associated with general paralysis.

Though the virus of epidemic encephalitis has a specific affinity for the nuclei in the basal ganglia, resulting in a large number of choreoathetoid, dystonic, and parkinsonian syndromes, both at the time of the acute process and later as a chronic degenerative lesion, this is not so with syphilis. The spirochetes rarely invade the lenticulostriate region, but that such a localization does occur is reported not only by others but also in the case cited in this paper. It is conceivable that even in the cases of this type an abortive infection with encephalitis had occurred whose presence was unrecognized. However, the pathologic examinations are convincing and the parkinsonian syndrome of neurosyphilis is established as a disease entity, its recognition depending on the zeal exercised in the study of that syndrome.

Treatment in this condition seems, from the histologic standpoint, to be hopeless; restoration of the function of the corpus striatum seems beyond even the possibilities of arsphenamine and its associated spirocheticides. This assumption is borne out by the case reports in the literature and by my own experience.

DISCUSSION

Dr. James B. Ayer, Boston: Antisyphilitic treatment is of little avail in these patients. I have seen three such cases, two men and one woman, in which the parkinsonian picture appeared with the clinical and laboratory characteristics of syphilis. One man did not respond to treatment at all; the other improved to a moderate extent with antisyphilitic treatment, but grew better with the administration of scopolamine, which certainly relieved him. The woman was the most interesting from a therapeutic point of view. She responded slowly, but after

16. Wigton, H. A.: Nebraska M. J. **9**:345 (Sept.) 1924.
17. Christian, T. B.: Am. J. M. Sc. **157**:271 (Feb.) 1919.

continuous treatment for a period of about four months was much better. I have been able to follow this case for a year and a half and saw the patient the other day. There is absolutely nothing in the case at the present time that would suggest parkinsonism.

Dr. Irving Pardee: In the literature it is generally conceded that antisyphilitic treatment is of no avail in improving the clinical symptoms in this type of parkinsonism. In the first of my two cases, antisyphilitic treatment has resulted in a normal spinal fluid, and the patient has returned partially to his occupation. However, he has not lost the parkinsonian signs; they are only ameliorated. The symptoms of the second patient have rapidly progressed and are becoming constantly worse.

Abstracts from Current Literature

A Peculiar Symmetrical Motor Disturbance of the Eyes. (The Syndrome of Internuclear Interruption of the Posterior Longitudinal Bundle.) Nils Antoni, Jahrb. f. Psychiat. u. Neurol. **45**:15, 1926.

Antoni has recently had occasion to observe three patients with typical multiple sclerosis who presented the following syndrome: On looking to the extreme right or left the adducting eye lags behind with a resulting divergent strabismus and crossed diplopia; at the same time the abducting eye shows marked nystagmus, which may be coarse at one time and rapid at another; the nystagmus varies in frequency in different cases but is almost always coarser than that observed in experimental vestibular stimulation; its amplitude is ordinarily large, but occasionally unusually so. The entire syndrome may then be summarized as a bilateral internal rectus paresis for lateral gaze associated with an "externus" nystagmus.

Extra-ocular muscle palsies may be peripheral or supranuclear in type; in the case of the internal rectus muscle it is well settled that when the ability to converge is retained the paresis is supranuclear. In the author's three cases, convergence was retained in every one, although both recti interni were unable to function on lateral gaze. It is this dissociation between the function of the internal rectus as a lateral rotator and its function as a converger that is the basis of the peculiar phenomenon described in this contribution.

In typical pontile "Blicklähmung," convergence is also retained, but there is inability to rotate the eyes laterally beyond the midline; in bilateral pontile "Blicklähmung" there is inability to move the eyes to the right or left. Pontile "Blicklähmung" is the result of involvement of the abducens nucleus in the posterior part of the pons. As "Blicklähmung" indicates a weakness of the abducens on one side and of the internal rectus on the other, it follows that the volitional impulse for lateral gaze reaches the region of the abducens nucleus before that of the internal rectus nucleus — in spite of the fact that the nucleus of the oculomotorius (of which the nucleus of the internal rectus is a part) is located more craniad in the mesencephalon than the nucleus of the abducens. In all probability there exists a "center" for lateral gaze rotation near the nucleus of the abducens — a synapse from which the cortical impulse is transmitted to the nuclei of the other ocular muscles. It is generally assumed that the posterior longitudinal bundle is the tract that conveys the impulse from the "gaze center" to the nuclei of the ocular muscles. This tract is well known anatomically; it consists of a pathway running longitudinally on each side of the midline close to the raphe under the floor of the rhombencephalon; it constitutes, among other things, the anatomic connection between the nuclei of the oculomotor and abducens nerves. It has been recognized for a long time as the brain stem pathway for "gazing." This has been confirmed clinico-pathologically by Bertelsen and Rönne who found that degeneration of this tract is followed by the syndrome of complete paralysis of lateral gaze with retention of convergence.

It is also well known that ocular movements are not only influenced volitionally but also reflexly — especially from the vestibularis. As the posterior longitudinal bundle connects the nuclei of the ocular muscles not only with each other but also with the central nuclei of the vestibular nerve, it stands

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to reason that this tract conveys reflex vestibular as well as voluntary cortical impulses to the respective ocular muscle nuclei.

Bearing all these facts in mind it can readily be seen that the syndrome discussed is the result of an interruption of the posterior longitudinal bundle between the nuclei of the oculomotorii and abducentes; the voluntary impulse readily reaches the abducens but not the internal rectus, so that on lateral gaze the former fulfils its function but the latter does not; e. g., on attempting to look to the right, the right eye can be brought out completely whereas the left eye is unable to go beyound the midline. The posterior longitudinal bundles lie so close to each other that a small lesion may be sufficient to involve both bundles and produce a bilateral symmetrical loss of function. The fact that convergence remains undisturbed just as it does in paralysis of lateral gaze due to pontile lesions would seem to suggest that the convergence impulse is conveyed through an entirely different pathway than the impulse for lateral rotation, and hardly extends craniocaudally beyond the nucleus oculomotorius. The occurrence of plaques in the posterior longitudinal bundle between the nuclei of the oculomotorius and abducens would thus explain the pathogenesis of the syndrome under discussion, and it is well known that such lesions are not at all infrequent in multiple sclerosis involving the brain stem.

This theory of the physiology of this phenomenon finds corroboration in the usual results of the Bárány tests. Antoni has actually found that in these cases the injection of cold water into the ear is followed by an intensification of the spontaneous nystagmus in the abducting eye (on the opposite side), whereas the injection of warm water into the same ear abolishes the nystagmus; rotation is followed by the usual reactions in the adducted eye, i. e., nystagmus cannot be observed. This would seem to confirm the view that both the voluntary and reflex vestibular impulses utilize the same pathways to the nuclei of the ocular muscles. Antoni admits that this syndrome has been described by previous authors, but none of them has mentioned the occurrence of nystagmus in the adducted eye. This component of the syndrome Antoni would attribute also to a dissociation within the supranuclear "gaze" pathway, i. e., to repeated corrective impulses that reach only the external rectus nucleus.

KESCHNER, New York.

A CLINICAL AND PATHOLOGICAL RÉSUMÉ OF COMBINED DISEASE OF THE PYRAMIDAL AND EXTRAPYRAMIDAL SYSTEMS, WITH ESPECIAL REFERENCE TO A NEW SYNDROME. JEAN LHERMITTE and DOUGLAS MCALPINE, Brain **49**:157 (June) 1926.

Little attention has been paid in the past to cases that show clinical evidence of involvement of both pyramidal and extrapyramidal tracts such as are encountered in pseudobulbar paralysis on the one hand and paralysis agitans on the other, and only a small number of references are present in the literature. Lhermitte, Cornil and Quesnel regard the following as the main points that characterize the pyramidopallidal syndrome: (1) gradual onset and slow progression without the occurrence of sudden vascular accidents; (2) the presence of pseudobulbar phenomena such as dysarthria amounting to aphonia, dysphagia, and involuntary laughing and crying; (3) marked muscular hypertonus, which combines the characteristics of both pyramidal and extrapyramidal disease, the rigidity affecting all muscle groups but being more marked in proximal than in distal groups, and the cogwheel phenomenon, which is so characteristic of parkinsonian rigidity, usually being absent; (4) the posture of the limbs which does not show any distinctive feature, except that the hand assumes

the posture seen in paralysis agitans; (5) the muscular power, which is fairly good and the existing general paralysis, associated with slowness of movement, which is less the result of the pyramidal lesion than of the marked hypertonus of extrapyramidal origin.

The following case points to involvement of the pyramidopallidal systems with, in addition, evidence of involvement of the neostriatum as shown by the presence of choreiform movements:

A man, aged 60, first noticed weakness in the lower limbs at the age of 52; this progressed and in a short time walking became difficult. Examination revealed a bilateral spastic general paralysis of the pyramidal type, with increase of tendon reflexes and bilateral Babinski sign. There was likewise some slight motor difficulty in the upper limbs. At 56, the man improved and walked fairly well. Two years later he presented the clinical picture of paralysis agitans without tremor and without involvement of the facial muscles. There was a bilateral extensor plantar response as previously reported. Involuntary movements, choreiform in type, were present in the muscles of the jaws, pharynx, larynx, and at times of the left hand. There was also considerable articulatory difficulty.

The brain was studied pathologically in great detail, serial sections being made of the entire halves; the main observations were: (1) putamen: marked reduction in the cells, with accompanying neuroglial overgrowth; degeneration of many of the myelinated fibers running from the putamen into the globus pallidus and the ansa lenticularis, many of the fibers arising in the caudate nucleus also being affected; (2) globus pallidus: slight reduction in the number of cells with mild neuroglial overgrowth but to no such degree as in the putamen; mild degeneration of certain fibers going to the ansa; (3) ansa lenticularis: definite reduction in volume; (4) substantia nigra, red nucleus and thalamus: normal; (5) pyramidal tracts: definite degeneration below but not evident above the middle of the medulla; (6) cortex and cerebellar systems: normal.

An excellent clinical and pathologic differentiation of this disease from allied conditions such as Parkinson's disease, pseudobulbar palsy, and spastic pseudosclerosis is presented; the authors regard their case as one of typical progressive pyramidopallidal disease to which choreiform movements were added.

The final part of the paper discusses the physiopathology of this and allied cases, especially in regard to involuntary movements. To the degeneration in the pyramidal tracts is attributed the spastic general paralysis and the double plantar extensor response, and to that of the globus pallidus the parkinsonian rigidity and the loss of associated movements. The authors attribute the involuntary movements to the marked pathologic changes in the putamen. They assert that pyramidal lesions arrest involuntary movements; in their own case the involuntary movements were almost negligible in the limbs but were pronounced in the tongue, pharynx and face; this is explained by the integrity of the pyramidal tracts above the middle of the medulla, which leaves the corticobulbar fibers intact and interrupts the corticospinal fibers below the medulla. They insist that as a prerequisite to involuntary movements there must be diminution of muscular tonus, as seen in Huntington's chorea. "Should for any reason a hypertonus, pyramidal or extrapyramidal, be grafted on to a case of chorea, the involuntary movements abate considerably and even disappear." The authors discuss at length Wilson's theory of cortical origin for athetosis — either a lesion of the frontal cortex itself or interference with the cerebellothalamocortical fibers. He postulates these fibers as acting on a

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higher motor center in front of the rolandic area; interference with impulses reaching this center releases the lower motor center (Betz cells) from inhibition by the higher center.

From the evidence afforded by their own case as well as that in cases of Huntington's chorea which present well marked changes in the putamen and caudate nucleus, the writers conclude that "no theory as to the pathogenesis of choreo-athetosis is adequate that does not take into account the neostriatum as a factor in the production of such movements."

STACK, Milwaukee.

PERMEABILITY CHANGES IN MENTAL AND NERVOUS DISEASES. P. BUCHLER, Arch. f. Psychiat. u. Neurol. **77**:613 (July) 1926.

The question of the relative permeation of different substances from the blood stream into the central nervous system and the importance of determining it in various diseases is discussed. The author reviews the literature on the subject, and on the basis of a large material of his own draws conclusions as to the value of such determinations. All investigators agree that a certain barrier exists between the blood stream and the cerebrospinal fluid, a barrier which prevents certain substances from coming through into the central nervous system, and one that shows certain changes in the degree of permeability in different conditions.

As to just where this barrier is, opinions differ. (1) Some take the choroid plexus as the filter and the protective barrier in the central nervous system (von Monakow, Mestrezat, Goldman, et al.). Monakow finds changes in the choroid plexus associated with manic-depressive psychoses, schizophrenia and general paralysis. A great many investigations, however, by others (Zalkas and Zanger) seem to point to the fact that the plexus does not play any decided rôle in determining permeability. (2) Other investigators are of the opinion that this barrier is represented by the meninges, especially the pia. One of the chief exponents of this theory is Zylberlast-Zand, who finds specific cells in the pia (histiocytes) that resorb the vital stains and seem, according to her, to represent the protective barrier of the central nervous system. (3) Finally, some authors believe that the permeability barrier is in the vascular system, the ependyma, the endothelia of the vessels, etc. They believe that the vessel wall is not a simple membrane, but a physicochemical protective organ that has specific permeability relations to different substances. All of these ideas have as many adherents as opponents, and the investigations show material that can be taken to prove any of them.

As to the rôle that changes in permeability, wherever their seat, play in causing pathologic conditions, some authors, especially Hauptmann, go as far as to state that a great many lesions of the central nervous system are due to an intoxication brought about directly by these changes. Animal experimentation is cited as proof of this theory, which asserts that the pathologic conditions in tabes, general paralysis, etc., are not due to action of the spirochete on the parenchyma but to the action of toxins that filter through the injured barrier and thus gain entrance into the parenchyma of the central nervous system.

Of the methods, the author prefers the Hauptmann modification of the Walter "Brom-method" in which sodium bromide is given orally and the cerebrospinal fluid is examined in the following way: the albumin is precipitated by trichloracetic acid and then brown gold bromide is formed by treating the filtrate with gold chloride. This is then examined colorimetrically and compared

with the bromide content of the blood. The permeability quotient is established by dividing the bromide content of the blood by that of the cerebrospinal fluid.

The author found the following results: In all cases of syphilitic conditions of the central nervous system, permeability was increased. This was most marked in tabes, then in general paralysis, then in syphilis of the central nervous system, and finally in the tabetic type of general paralysis. Cases of schizophrenia showed the opposite; that is a tendency to decreased permeability. The vascular diseases (arteriosclerosis) and the senile psychoses showed a marked increase in permeability. Some intoxications, such as that of morphine, showed decreased permeability; encephalitis showed a tendency to increase.

In analyzing his cases, the author finds this important factor: the permeability is low in young patients and increases gradually to reach what is considered the normal adult level at about the age of 30 or 40, and then increases further with advancing age. This increase is further influenced by the conditions of the vessel walls and the tension. Thus, arteriosclerosis or a syphilitic condition of the vessels causes marked increase in permeability, and the same is brought about by high pressure.

The author concludes: (1) The permeability is directly dependent on the condition of the vessel walls and the blood tension, and this factor speaks for the justification of the assumption that the barrier is in the vascular system. (2) He does not believe that this barrier is of as much importance in protecting the central nervous system as some think; certainly, that it is not the sole factor in causing some of the diseases, and that it is more of a symptom in the disease syndrome. (3) When one discounts the influences of age and vascular changes, one finds no characteristic permeability state in any recognized disease entity. The fact that in schizophrenia the permeability is lowered and in general paralysis and tabes, etc., increased will depend more on relative age limits of these diseases and the general vascular condition in syphilitic disorders.

MALAMUD, Foxborough.

STUDIES OF CEREBRAL FUNCTION IN LEARNING: VII. THE RELATION BETWEEN CEREBRAL MASS, LEARNING AND RETENTION. K. S. LASHLEY, J. Comp. Neurol. **41**:1 (Aug.) 1926.

This paper is one of a series of correlated studies made by Lashley during the last few years on cerebral function in learning. It is a report of experiments devised to show the influence of the extent of lesions within the visual area of the rat on the formation and retention of habits of discrimination of brightness. It is a further attempt to give some clue as to the manner in which cerebral mass contributes to complexity of function. The experiments were exceedingly well controlled. The rats were trained, in a Yerkes' discriminating box, to enter an illuminated compartment, rewarded by food, and to avoid a darkened compartment, rewarded by punishment. The study of quantitative results was sought by measuring the amount of practice necessary to establish the habit and the amount of loss subsequent to operation. Perfect learning constituted ten successive errorless trials on each of three successive days.

An attempt was made to destroy every part or combination of parts of the occipital cortex. The lesions were restricted to this region in both hemispheres in every operation and were performed with thermocautery under ether anesthesia. The extent of the injuries of the brain in each of 112 cases is shown by diagrams made from measurements taken at necropsies. The effects of shock from operation and irritation of the wound and diaschisis have been ruled out.

In group *A*, consisting of forty-eight rats trained for seven days after operation, the rate of initial learning was almost identical with the initial rate of learning in forty-eight other rats not operated on. The extent of destruction of the occipital third of the cerebrum ranged from 3.5 to 43.9 per cent of that region, and the results of the experiments show that whether the lesion is slight or extensive it has no effect on the ability of the animals to form habits of discrimination of brightness.

In group *B*, a comparison in forty-eight cases of the number of trials and errors before and seven days after operation gives some idea of the retention of the habits of discrimination of brightness. In learning, the average for this group before operation was 128.2 trials to 41.8 errors. Seven days after operation the average for retaining was 44.6 trials to 13.7 errors, showing that lesions of from 1.5 to 31.9 per cent of the neopallium produced a definite loss equivalent to only about one third of the effect of initial practice. Some lesions, then, within this range reduce the retention of visual habits, but as shown in the preceding group, do not have any effect on subsequent initial learning. If one examines the individual animals in this group it is revealed that many with slight lesions do not show disturbance of habit following operation, whereas those with extensive lesions often require as many trials for relearning as for the initial learning. This is a significant and important fact, for it shows a surprisingly close relationship between loss of memory and extent of injury.

Preliminary retention tests on rats before operation, given after an interval of seven days rest from the initial training, show such a small number of errors that the loss from disuse is negligible in considering the effects of operation. This is further tested out in group *C*, composed of a smaller number of cases in which the preliminary retention tests were made after a rest period of fourteen days instead of seven. The loss from disuse was a little greater but not sufficient to mask any recovery from operative shock, if this occurred. Extensive injuries were made in this group, and retention tests were made fourteen days after operation. However, when cases are selected from group *B* (retention tests being made seven days after operation) in which extensive injuries also were made, the results of the retention tests in the two groups with equal amounts of destruction are not far different. Therefore, the post-operative intervals before retention tests were made have given sufficient time for ruling out general shock or temporary diaschisis as an important factor in determining the value of these tests.

Lashley has shown in these experiments that there is no focal or common spot in the occipital cortex that controls this function of discrimination of brightness, but that various parts, if left, are equipotential for the performance of the habit. He has shown in previous publications that the habit of discrimination of brightness survives the destruction, singly, of the frontal, temporal and parietal areas of the cerebrum and has therefore shown in this admirable work that the cerebral mechanism of the visual habit is largely confined to the occipital region. One cannot fail to be impressed by the significant bearing these results of Lashley's will have on a reconsideration of the present views of the functional areas of the brain.

STONE, New Haven, Conn.

FURTHER STUDIES IN ENCEPHALOGRAPHY AND MYELOGRAPHY. R. WARTENBERG, Arch. f. Neurol. u. Psychiat. **77**:4 (July) 1926.

Previous reports by the author in connection with encephalography and myelography are supplemented by the present study of the diagnostic value of this procedure in pathologic conditions, other than new growths, in the central nervous system. Five cases are reported.

Case 1.—Skull trauma (right frontal lobe) resulted in gradual deterioration of intellectual faculties and epileptic seizures without other neurologic symptoms twenty months after the accident. The encephalogram showed marked dilatation of both lateral ventricles with rounding of the corners, spherical dilatation of the third ventricle, and widening of the intracerebral subarachnoid spaces. These symptoms, according to the author, are particularly common in senile atrophy and in general paralysis, and in this case pointed definitely to an atrophic process in the whole brain. In some cases of epilepsy, the author, as well as Foerster, was able to interpret encephalograms as showing indications of localized lesions. It seems that the brain reacts to injuries of the skull by shrinking and atrophy, with consequent change in the size and configuration of the ventricular system. In this case, too, although the whole ventricular system was dilated, the septum pellucidum, as well as both lateral ventricles, was pulled over toward the site of injury. An operation revealed a pathologic process consisting of numerous adhesions and cystic formations about the site of trauma, but the clinical picture was too far advanced to admit improvement.

Case 2.—Gradually progressing psychic deterioration in the form of memory disturbance, difficulties of attention and character changes, as well as absence-like disturbances followed an occipital injury which resulted in a slowly healing purulent scalp wound and a skull depression. Twenty-one months after the accident neurologic signs other than the psychic were not present. The encephalogram showed slight dilatation of the whole ventricular system, especially of the third ventricle. The right lateral ventricle was larger than the left, especially in the posterior horn (the injury was on the right side). Here again the symptoms were interpreted as indicating atrophic changes in the brain, especially of the part at the site of the injury. In both cases, the author emphasizes the fact that, neurologically, apparently negative clinical pictures were found when encephalography showed definite pathologic changes in the brain.

Case 3.—This was a case of pachymeningitis hemorrhagica interna, in an alcoholic man, aged 41 years. Eight days after an injury to the head, the patient developed signs of hemiplegia, choked disk and aphasic and psychic disturbances. After a short stay in the hospital the condition began to improve. Encephalography showed the whole ventricular system pushed over to the side opposite the one on which the injury occurred and marked dilatation of the lateral ventricle on that side. Thus there was an indication of increased contents on the side of the injury, and an operation revealed a large subdural hematoma.

Case 4.—In a case of commotio cerebri following an occipital injury, symptoms gradually developed in the course of years with disturbances of sensation in the hand opposite the lesion (anesthesia and analgesia fading into hypalgesia and hypesthesia in the arm). As time went on, this disturbance of sensation spread further up with definite astereognosis and loss of sense of position. With this in time occurred a development of motor weakness. It was therefore a case of disturbance of central sensation following concussion. The encephalogram here did not show anything definite, as one could expect, judging by the chronicity and most probably the small size of the lesion. Nevertheless, the lateral ventricle of the injured side was larger than the other, and its margins were rounded out. The gyri over it appeared somewhat shrunken.

Case 5.—This case was diagnosed clinically as compression myelitis at the fourth thoracic vertebra. The introduction of iodized oil 40 per cent both from above the lesion and below it confirmed the diagnosis in that it showed a block. Operation did not show any lesion in the cord itself outside of edema and con-

gestion at the diagnosed site. There was an exitus and at postmortem a small metastatic carcinoma was found in the body of the third dorsal vertebra.

The author comes to the conclusion that air encephalography is useful as a diagnostic aid, not only in neurologic growths but also in different types of diseases of the brain. In these cases, the pathologic changes can be shown even when the neurologic picture is negative.

As to myelography with iodized oil 40 per cent, the author believes that it is not quite as reliable as a thorough neurologic investigation and that in addition is not an altogether safe method of procedure.

MALAMUD, Foxborough, Mass.

DISCOVERY OF THE VISUAL CENTER. ANSWER TO THE OBJECTION OF PROFESSOR LENZ ON THE WORK OF HENSCHEN. S. E. HENSCHEN, Ztschr. f. d. ges. Neurol. u. Psychiat. **102**:368 (May) 1926.

Henschen devotes most of his article to replying to Lenz, who claims that in the former's work not enough cognizance was taken of Lenz's work on the optic system, and especially on the localization of the macula. Lenz, in his article entitled "The Forty Year Battle," not only renews the old arguments between Monakow and Henschen and also many other moot points, but also tries to draw illogical conclusions according to his own point of view. He complains that Henschen's views on localization in the occipital pole were published in 1907, simultaneously with a case of Wilbrand's, and finds it hard to understand that what was probable in 1890, when Henschen was beginning his work, was proved in 1907. To this Henschen replies that herein is illustrated the theories of a young investigator corroborated by facts collected in later life. Moreover, he states that though Lenz attempts to reduce all his work on the anatomy of the brain to nothing he arrives at the same conclusions which he had reached decades ago. He then discusses some of the outstanding problems with regard to the visual center, in each case replying to certain objections of Lenz.

In the first place, experimentalists, about three decades before the clinicians, pointed out the existence of a visual center. Hitzig first expressed the view that a visual center existed in the occipital lobe of the dog. Ferrier localized the visual center in apes in the gyrus angularis, a view corroborated by Horsley, Schäfer, Luciani, et al. and opposed by Munk. Later, the significance of the occipital lobe was recognized by Ferrier and Luciani, central vision being localized in the gyrus angularis. During the long battle between Hitzig and Munk, the former finally concluded, in 1904, that primary vision was located in the subcortical visual ganglia, but that psychic vision was located in the occipital lobe. Munk, however, clung to his original view: that the center of vision was localized in the lateral occipital cortex as was the macula. Things stood about here when Henschen began his investigations. Von Monakow had localized the cortical field of vision in the occipital and angular cortex, but denied the existence of a sharply-circumscribed visual center. From 1890 to 1892 appeared Henschen's work, opposed by von Monakow, and of which Lenz now says, "Only the assertion of Henschen that the radiations of Gennari contain optic fibers is now held." To this Henschen details proof to show that many other things are held as proved. The discovery of the visual center dates from 1886, when Henschen claimed, on the basis of a pathologic study, that the visual center was to be found on the medial occipital cortex about the calcarine fissure. Only Wilbrand supported this view, reported at many congresses, but others opposed it and placed the visual center in almost every

other part of the brain—even the caudal portion of the parietal lobe was implicated (Ferrier, Horsley, von Monakow). The main evidence for the localization of the visual fibers in the occipital cortex, however, rests on the proof that the latter has a specific structure—and Henschen gives himself credit for calling attention to this. Brodmann said, "We have Henschen to thank for a sharp limitation and exact localization of the cortical optic center." With this Laqueur agrees, and also Minkowski, who says, "All authors agree that the area striata was discovered as the assumed localization of the visual functions on the basis of Henschen's anatomicopathologic investigations."

The discovery of the localization of the cortical macular representation was attended with much controversy. Up to 1907 the existence of an isolated macular visual field was denied, its localization being placed in the external geniculate body. In 1907 and 1908, it was possible to prove the existence of a cortical macular field on the basis of cases reported by Henschen and Wilbrand. The patient of the latter developed a macular and perimacular scotoma following an accident. Necropsy was not performed, but the lesion was placed in the occipital pole. Henschen's case was studied at necropsy, and he is given full credit by Wilbrand for the macular localization. Cases of Foerster-Sachs, Schmidt-Rimpler, Binswanger and Peters, however, point to the fact that the macular center is localized frontal to the pole.

Lenz claims to be the first to discover the location and limitation of the visual area in the cortex. In 1900, however, Bolton studied the problem and reached the same conclusions as Lenz. The rest of the paper, like the first portion, is purely controversial and therefore is only of limited interest.

ALPERS, Philadelphia.

SYMPATHETIC RAMISECTION FOR THE RELIEF OF SPASTICITY. EDITORIAL, J. A. M. A. **87**:851 (Sept. 11) 1926.

Is there a physiologic basis for the surgical operation of ramisectomy as a relief in spasticity of the extremities? Is the operation successful? The latter may be true without the former, but the history of the solution of other scientific problems would not bear out such a supposition. Since Hunter's untimely death, the larger number of scientific contributions have appeared from those whose conclusions diametrically oppose those of Royle and Hunter. These contributions have included both experimental and clinical data. In the same issue of THE JOURNAL Dr. Royle (The Surgical Treatment of Spastic Paralysis by Sympathetic Ramisection, Correspondence, p. 868) presents his view of these observations, contributing, however, no further scientific facts as evidence of his beliefs.

Royle's criticisms of the work of Kanavel, Pollock and Davis are concerned for the most part with the type of animal and the method of decerebration used in their experiments, together with a statement that the patients reported on by them were not suited for the operation. In this connection it is interesting to note that the work of these observers has been fully corroborated by Ranson, Forbes and Cannon, Meek and Crawford and others. Forbes and Cannon (Muscular Rigidity With and Without Sympathetic Innervation, Arch. Surg. **13**:303 [Sept.] 1926) used cats in their experiments and decerebrated their animals by the Sherrington method, which of course is the method used by Royle. Their statement that "if there were a physiologic phenomenon of significance for mammals in general and therefore having a bearing on human surgery, it should be possible to demonstrate it in the cat" is quite applicable.

It is also interesting to note that in their report of the three patients operated on eighteen months previously, Davis and Kanavel have stated that two of the patients were operated on by Dr. Royle and that all three had been chosen by him from a large group of children as the cases most suitable for operation.

Not all the evidence contrary to the practice of Royle and the theory of Hunter has been confined to this country. In an interesting symposium on the "Sympathetic Innervation of Striated Muscle" presented before the Section of Neurology of the Royal Society of Medicine, Bankart and Jefferson (Proc. Roy. Soc. Med., Sec. Neurol., August, 1926, vol. 19) reported on the result of their operative procedures on patients with spastic extremities. Both of these surgeons make the rather bald statement that the operations did no real good. Further, considerable doubt has been thrown on the accuracy of Kulschitsky's histologic evidence and Langellan's theory of muscle tone, on both of which premises much of Hunter's theory was based. As Walshe has pointed out, Trendelenburg twenty years ago performed experiments on the wing of the fowl similar to those of Hunter but with opposite results. It has been suggested and may be repeated frequently and appropriately that in the absence of published careful anatomic control observations, injury to the ventral root provided a probable explanation of Hunter's results.

It would seem that the most aid that could be given in support of the theoretical and practical aspects of the subject might come from added reports of carefully controlled scientific experimental and clinical observations. The final conclusion of Forbes and Cannon is a challenge to the supporters of this theory to produce just such work. It bears repetition: "We conclude that if there is any loss of tonus in consequence of the operation it is insignificant. Certainly decerebrate rigidity persists, at least approximately undiminished, and manifests its plastic features after sympathectomy. This conclusion removes the alleged physiologic basis for the surgical operation of ramisection as a cure for spasticity. If patients are in reality improved in consequence of this operation, it is probably due to some incidental feature of their treatment, and not to the interruption of nerve impulses arising in the sympathetic nervous system."

PSYCHOANALYSIS AS A CULTURAL FACTOR. OTTO RANK, Ment. Hyg. **10**:721 (Oct.) 1926.

Psychanalysis is useful, not merely as a theory or a therapeutic method, but also in its applicability to the daily realities of life. This is evidenced by the fact that it has always been related to folk-beliefs and popular traditions, which may account for some of the resistance to it on the part of scientists, who note the resemblances in psychanalysis to forms of art. The natural sciences have been reluctant to employ the psychanalytic principles in research, whereas analysts have pointed the way to problems that require the services of specially trained experts in various branches of knowledge. However, many special fields of investigation are being influenced by psychanalysis.

In neurology and psychiatry there is a tendency to subdivide the neuroses into smaller groups. Analytic study of the hysterical symptom, which lies in the borderland between the physical and the mental, has suggested new methods of approach in medicine. The internist especially should be acquainted with such mechanisms of unconscious motivation as, for example, those involving psychic gain from illness. The surgeon should be aware of the neurotic wish for operation when libidinal factors (for example castration and birth) may

be active. The dangers of certain postoperative psychic effects should be taken into consideration. Medical students would undoubtedly profit by a thorough course in psychanalysis.

In relation to the general social life, psychanalysis has given insight into such processes as the productions of artists, showing how, for example, the poet works with and creates from his own unconscious. Mythical literature has verified many psychanalytic theories. The influence of psychanalysis on modern art apparently is not producing new forms and problems, but seems rather to demonstrate that the forms depend on the unconscious material which probably has not altered for generations.

The psychanalytic study of religious phenomena indicates that many of these activities depend on infantile fixations — for instance, certain ceremonials of self sacrifice related to feelings of guilt, masochism, and to unattainable wish goals. Psychanalysis itself is a phenomenon of the times, representing man's attempt to discover more efficient and appropriate conventions to supplant traditional customs and beliefs. In individual ethics, psychanalysis does not advocate abandonment to suppressed impulses, but a better conscious mastery of them. It may be possible to develop a new sexual ethics on the basis of data obtained through psychanalysis. Educational measures may be carried out after freeing the individual from infantile feelings of guilt.

Although natural science is attaining an increasingly better insight into reality, even in this field of endeavor the unconscious factors play an important rôle. Man has had a tendency to falsify the outer world by projecting into it his own unconscious. Thus art, philosophy and religion are, to a large extent, influenced by the reflection of man's unconscious. Science is not yet completely emancipated from this domination, but it is to be expected that, with extension of consciousness into the realm of the unconscious, tremendous intellectual progress will be made. Psychanalysis always retains a firm grasp on reality since it is primarily concerned with the adjustment of the inner world to the outer life.

EISLER, Chicago.

BERGSON'S CONCEPTIONS AS APPLIED TO PSYCHOPATHOLOGY. E. MINKOWSKI, J. Nerv. & Ment. Dis. **63**:553 (June) 1926.

Experimental and physiological psychology fails to explain a large fraction of psychic reality, which is important but inaccessible to experiment. In psychology one deals with elements of the psyche and neglects the organization of these elements into a progressive and mutually integrated stream. Psychology and psychiatry can gain much from the inexhaustible supply of psychologic observations which all true philosophy provides. Between intellect and instinct Bergson has stressed a fundamental opposition and has described intellect as working with solid, unorganized and immobile processes. In Bergson's words, "Intellect rejects anything fluid and solidifies everything it touches." How can Bergson's conception illuminate psychopathology? In the healthy personality, intellect and instinct mutually blend and form a harmonious whole. Under pathologic conditions this harmony may be disturbed, and one may find intellect compensating for some early deprivation of instinct: The author compares the mental disturbances characteristic of general paralysis with those of schizophrenia. In the former, there is a loss of judgment and memory, while the memory is preserved in schizophrenia. The author sees two different factors involved in the location of space, one the static factor which places objects in relation to one another in geometric space, and the

other which is the feeling of self expressed in the concept "I am here now." In the general paralytic patient, the static factors are at fault. He is disoriented in space but the structure of the "I am here" is intact, whereas the schizophrenic patient knows where he is but the "I am here" feeling has no longer its normal value and collapses. He refers to himself as "my personality" or "energy" or some other equally impersonal term. Thus, the general paralytic patient retains what the schizophrenic patient in an advanced stage often does not keep—his personalization.

The schizophrenic patient retains the static but loses the dynamic factor, while in the general paralytic patient the notion of measurable duration is often abolished, and the faculty of relating experiences to a fixed point ceases. For the paralytic, everything is then in movement, a movement to which there is no obstacle and which overwhelms the individual. He will go to the moon or ride in autos that go 500 miles an hour, or will free the animal kingdom. What is missing in the schizophrenic, on the other hand, is that rational, harmonious sentiment of life which hardly allows itself to be intellectualized. Intuitions and ideas of measure and limit do not function in him, and the richness and mobility of life disappears. He may try to direct his conduct on mathematical criteria, determining the value of objects and events solely according to their dimensions or geometric characters. A mania for symmetry, a morbid geometrism, is thus set up. He will maintain poses that will secure absolute symmetry for his body. He becomes incapable of assimilating change and sometimes seeks immobility. Thus does the author see a striking application of Bergson's conceptions to psychopathology.

HART, Philadelphia.

HEART CRAMP IN SPASMOPHILIA. THE PROBLEM OF TONE AND THE QUESTION OF EPILEPSY. G. PERITZ, Ztschr. f. d. ges. Neurol. u. Psychiat. **102**:395 (May) 1926.

Peritz maintains that some patients who complain of pain in the heart are looked on as neurasthenic or hysterical, but who in their venous curve show a cramp-like state of the heart muscle. The majority of these are spasmophilic. Angiospasm is one of the chief symptoms of spasmophilia in adults, and angiospasm of the coronary vessels plays an important rôle in the origin of heart cramps. The removal of this angiospasm by caffeine or euphyllia alleviates the heart cramp. The mechanism of the condition is explained by the chemistry of muscle contraction, in which lactic acid is produced by anoxybiotic action, causing muscle contraction, and the removal of this substance by neutralization with acid and alkali leading to relaxation. If alkali is not brought to the muscle to neutralize the lactic acid, hypertonus results. The simplest explanation of this lies in the fact that the contraction of the vessels in the muscles prevents this neutralization. Peritz believes that the midbrain must be looked on as the regulatory apparatus in this condition, its removal from function causing hypertonus. The occurrence of heart cramps as an aura in epilepsy indicates that at the basis of epilepsy is a spasm of the cerebral vasculature. This angiospasm, however, need not be general, but may be confined to various regions, thus producing various types of attacks.

Peritz in recent years has come to look on cardiac cramps as an aura in epilepsy. Patients with such an aura have a uniform complaint: pain in the left breast, pressure and oppression in the chest, and often palpitation. In about ten cases of epilepsy such heart cramps occurred immediately before the attack. In intervals between the attacks, however, these cardiac symptoms have been prominent. The question of cardiac cramp has been investigated

carefully. Treupel and Pletnen look on it as angina pectoris vasomotoria, and believe that vasomotor disturbances play a great rôle in the condition. Mackenzie looked on it also as angina vasomotoria and called it the X-disease. Investigation shows that patients who complain of this condition are, as Mackenzie said, thin, young and often lethargic-looking. They are pale; the hands are cold; they often complain of dyspepsia and often show dilatation of the stomach and collection of blood in the abdominal veins; usually, there is also slight dilatation of the heart with a little irregularity. Examination of the heart during these cramps does not show anything of note, but the venous pulse tracing, by the method of Ohm, shows definite cardiac hypertonus at such times. Peritz concludes from his studies, as stated above, that these are really cases of adult spasmophilia, in which angiospasm plays a great part. While the vessels often are palpable in this condition, thickening of the vessel walls does not occur, but merely a marked spasm of the vessels.

ALPERS, Philadelphia.

THE PATHOGENESIS OF HYPERTENSION—A NEW THEORY. Current Comment in J. A. M. A. **87**:248 (July 24) 1926.

The immediate causes of arterial hypertension are still sufficiently uncertain to warrant a lively interest in any engaging new hypothesis. Studies on the pathogenesis of hypertension, carried out by Bordley and Baker (A Consideration of Arteriosclerosis of the Cerebral Vessels and the Pathogenesis of Hypertension, Bull. Johns Hopkins Hosp. **38**:320 [April] 1926) in the department of pathology of Johns Hopkins Hospital, have been stimulated by the demonstration of Anrep and Starling (Central and Reflex Regulation on the Circulation, Proc. Roy. Soc. London, B **97**:463, 1925) of London that a reduction in the amount of blood reaching the part of the brain concerned with vasomotor control brings about a compensatory rise in the systemic arterial pressure. This was effected by the ingenious experiment of making the circulation through the brachiocephalic artery of an experimental animal independent of the rest of the blood supply of the body. The circulation through the medullary vascular centers could thus be controlled and made independent of changes in the heart or in the splanchnic vessels. A fall in the blood pressure in the brain produced immediate vasoconstriction in the rest of the animal. Bordley and Baker have found arteriosclerosis in the medulla oblongata without exception in man in cases with a history of hypertension, whereas the arterioles in this region were found unaltered when there was a record of normal blood pressure. The Baltimore pathologists, recognizing the current belief that arterial hypertension is accompanied by arteriosclerosis in at least some portion of the body, suggest that a localization of this process in the medulla oblongata may be the essential factor in the production of persistent high blood pressure. The possibility remains, of course, that the anatomic changes may be secondary to the hypertension. Bordley and Baker tentatively conclude that there is at least an association between persistent hypertension and arteriosclerosis of the vessels supplying the brain stem.

ALLEGED STIMULATION OF AUTONOMIC NERVOUS SYSTEM IN ARSPHENAMINE REACTIONS. P. J. HANZLICK and C. H. THIENES, Arch. Dermat. & Syph. **14**:382 (Oct.) 1926.

It has been assumed that stimulation of the autonomic nervous system occurs after the injection of arsphenamine. This stimulation is supposed to be greatest in persons having undesirable reactions or "nitritoid crises," the assumption

being based on the temporary leukopenia that is more marked during the nitritoid crisis. It is thus assumed that acute leukopenia is the equivalent of autonomic nerve stimulation. The authors have made a series of tests of the basis for the alleged parasympathomimetic action of arsphenamine and report their results.

The first series of experiments was performed on excised uterine and intestinal muscle. The solutions used were: arsphenamine in concentrations of from 1:12,000 and 1:5,000, which equals approximately from one-half to the full concentrations that occur in the blood of a man weighing 60 Kg. after injection of 0.9 Gm. of the drug; neoarsphenamine in concentrations of from 1:5,000 to 1:10,000; sodium arsenite in concentrations of from 1:50,000 to 1:20,000. The responses to autonomic drugs were also taken after the use of arsphenamine and neoarsphenamine. Similarly, reactions were taken on intact intestinal muscle of a rabbit and on the muscle of the crops of nine pigeons.

The authors conclude from their experiments that arsphenamine and neoarsphenamine, per se, do not demonstrably affect the autonomic nerves of the alimentary tract. Some muscular stimulation of the excised rabbit colon, however, is generally demonstrable with neoarsphenamine. Also, they conclude that the claim, that the basis of nitritoid crises, accompanying the intravenous injection of the arsphenamine, is some functional alteration or involvement of the autonomic nervous system, is not sustained. This basis may consist of physicochemical changes in the blood and tissues.

WAGGONER, Philadelphia.

A STUDY OF THE SYMPATHETIC INNERVATION TO SKELETAL MUSCLE. S. TOWER, Am. J. Physiol. **78**:462 (Oct.) 1926.

Tower's objective in this work was the investigation of the supposed tonus function of the nonmedullated innervation of skeletal musculature. Her careful studies were carried out on dogs in which the stellate ganglion had been extirpated unilaterally. In this way it was possible to observe, in relative isolation, a body part (fore limb) known to be simply innervated sympathetically and easily denervated, with the opportunity at the same time of comparing phenomena manifested in it with a control member, the opposite foreleg. Prior to operation the animals were observed carefully from the standpoint of use and tone of the limb under normal and certain artificially induced hypertonic conditions, strychnine poisoning and parathyroid tetany. Postoperatively, these phenomena again were noted and the peripheral vascular relations as well. These observations were made at frequent intervals over a period of some months and included the following special conditions: rest, muscular work (treadmill) and the experimental hypertonus resulting from strychnine, tetany, decerebrate and ether rigidity. Tone and use of the fore limbs did not show differences in relation to rest or exercise traceable to sympathectomy. Strychnine and tetany were found to be followed by increased tonus on the extirpated side without especial changes resultant to decerebration or ether rigidity. In no category, however, was there significant evidence of actual loss of tone that might be anticipated if tonus were directly dependent as such on sympathetic innervation. Following operation, and more markedly in states of artificially produced hypertonus (strychnine and tetany), local circulatory defect was noted on the denervated side, essentially a lessened blood supply with lowered temperature. Tower believes this relation of defective peripheral circulation and hypertonus to be of considerable significance, suggesting that the former, probably largely through

the lowered temperature, may well represent an important conditioning factor with reference to the latter. In any case the conclusion is reached that in all probability the maintenance of skeletal muscle tonus is not in any sense a direct or specific function of its sympathetic innervation.

RAPHAEL, Ann Arbor, Mich.

ACTION TREMOR. H. DE JONG, J. Nerv. & Ment. Dis. **64**:1 (July) 1926.

The author distinguishes "rest tremor" from "action tremor" in cases of paralysis agitans and finds these tremors distinct from intention tremors. A rest tremor is characterized by a lessened intensity of tremor while slight movements of a limb are made, but an increase of intensity and amplitude occurs after the movement ceases. He defines an action tremor as one that does not increase in rest, but increases during movement or activity, such as speaking, reading and emotion. Both action tremor and rest tremor are increased by action or movement of longer duration. The lowered tremor that may accompany movement is explained by the muscular contractions of that movement preventing the tremor for a time from becoming obvious. A case of cerebellar disease with tremor, illustrative of the action type, is described and tracings are given. This tremor was diminished by the injection of 200 mg. of bulbocapnine hydrochloride. The action tremor differs from the intention tremor of disseminated sclerosis in that movement of any limb may cause the oscillation of the affected one. Intention tremor arises at the end of a movement, while action tremor is aroused by any physical or psychic activity. The amplitude of the oscillations of the intention tremor is unequal; that of the action tremor is regular and equal. The intention tremor has a frequency of 2 per second, while the action tremor has one of from 5 to 7 per second.

The author concludes that rest tremor and action tremor are only different degrees of the same phenomenon and are characteristic of striatal tremors. Rest tremor is a heavy action tremor. In normal persons a tendency to tremor is present under great exertion or emotion when a normal inhibitory mechanism is decreased. Hence, action tremor is a common phenomenon. The author regards clonus as due to heightened pyramidal tonus, while action tremor is really only an extrapyramidal clonus.

HART, Philadelphia.

EXPERIMENTAL INVESTIGATIONS ON CONVULSIONS: THEIR BEARING ON EPILEPSY. WALTER DANDY, J. A. M. A. **88**:90 (Jan. 8) 1927.

Dandy reports a series of experiments on dogs in which, under a large preliminary dose of morphine followed by ether anesthesia, a large bilateral cranial defect was made. Various parts of the intact brain were stimulated electrically, and later various parts of the brain were excised either during or before convulsions. Dandy and Elman, in a previous work on incision or inclusion of a foreign body in the motor area of dogs and cats, have shown: (1) that the motor cortex, once injured, causes the threshold at which convulsions appear to be lowered, and (2) that injuries to other parts of the brain did not produce such striking results but indicated the same thing.

Dandy believes that clonic convulsions due to tumors, whether jacksonian or generalized, are the result of cerebral tumors and also that clonic convulsions are evidence against tumor in the cerebellum or brain stem. Clonic convulsions were produced at will by direct stimulation of the motor cortex, and there is an optimal zone of intensity of stimulation.

The experiments, six in number, are reported in some detail. Dandy offers the following summary and conclusions: (1) that only stimulation of the motor cortex, or its subjacent fibers with the motor cortex intact, can produce clonic convulsions; (2) that with one motor cortex excised, clonic convulsions cannot develop contralaterally; (3) excision of both motor cortexes causes clonic convulsions to cease to be elicited regardless of the area stimulated or the strength of stimulus, and (4) that the cerebellum has no influence on the causation or prevention of clonic convulsions. The motor cortex is therefore alone responsible for clonic convulsions, but convulsions do not necessarily originate therefrom — the aura may give one an idea as to their place of origin.

CHAMBERS, Syracuse, N. Y.

AN EXPERIMENTAL STUDY OF THE ACTION OF HYOSCINE HYDROBROMIDE ON THE DEVELOPMENT OF THE NERVOUS SYSTEM OF AMBLYSTOMA. H. S. BURR and M. E. SNAVELY, J. Comp. Neurol. **41**:401 (Aug.) 1926.

The object of this paper was to find out what part of the nervous system is probably affected by scopolamine hydrobromide by using embryos of *Amblystoma* (a salamander). Much is known about the growth of the behavior pattern of this animal and its mechanism, through the long series of studies by G. E. Coghill. In fact, a number of investigators in this country are engaged at the present time on many and various studies of its nervous system. Using Coghill's observations in the development of the central and peripheral conduction paths as a basis, the effects of hyoscine on these conduction paths as they developed and began to function were noted.

Following the method of Coghill, tactile stimulation by means of a fine hair was made on embryos of various stages in development while kept in dilutions of 1:3,000, 1:5,000 and 1:10,000 of scopolamine hydrobromide. Narcosis was not evident until it was time for swimming movements to appear. When embryos were stimulated previous to this stage such movements as flexure of the head, coiled form of the trunk and sinuous movements of the trunk successively appeared in their normal order. At the time of the development of swimming movements, reactions became much retarded or absent.

It is suggested that the narcotic action manifests itself at this time because some center in the medulla or higher up, where marked differentiation is now evident, begins to act as an integrative mechanism on the motor system. The authors make the suggestion that the basal ganglia may be the center of involvement.

STONE, New Haven, Conn.

CORRELATIONS AND VARIABILITY OF THE CENTRAL NERVOUS SYSTEM AND BODY SIZE OF THE ALBINO RAT. FREDERICK S. HAMMETT, Biol. Bull. of the Marine Biological Laboratory **50**:509 (June) 1926.

This paper is an analysis of the weights of the brain and spinal cord, weights of the body, lengths of the body, and weights of the brain and spinal cord being used as raw data. The rats were 150 days of age at the time the organs were removed for weighing. Both sexes were used, 121 of each. Both the brain and the spinal cord are less variable than the body in weight. The lower variability of the central nervous system is obviously an expression of an inherently more stable chemical make-up. Evidence for this is had both in the fact that the brain and spinal cord are more resistant to conditions of malnutrition and inanition than the body as a whole, and in the fact that

the growth of these organs is more resistant to the metabolic upsets incident to thyroid and parathyroid deficiencies than is that of the body in weight. The variability in the weight of the brain is greater in man than in the rat. This is probably another expression of the difference between heterogeneous and homogeneous material. Both brain and spinal cord are more variable than the length of the body. In man also the weight of the brain is more variable than stature. This may be taken as an indication that skeletal composition is more fixed and metabolically stable than is that of the central nervous system. The brain appears to be less variable than the spinal cord. This is consistent with the fact that weight of the brain is less highly correlated with weight of the body of high variability than is the spinal cord.

COBB, Boston.

NARCOLEPSY. A SYMPTOM COMPLEX: REPORT OF A CASE IN A CHILD. A. A. WEECH, Am. J. Dis. Child. **32**:672 (Nov.) 1926.

The author reports two cases of narcolepsy. In the first case, a child, aged 7, began to show an extraordinary inclination to go to sleep at all times and in all places. This condition occurred after the child had struck her face against a piece of iron. No abnormality was noted on neurologic examination. The patient presented a symptom that previously had been reported by Spiller, and which the author terms "emotional asthenia." This term is used to describe the sudden attacks of weakness which narcoleptic patients experience following excitement. In the case under consideration "emotional asthenia" was manifested by attacks in which the child would suddenly tremble, become weak all over and fall to the ground when subjected to fright or some other excitement. The author regards "emotional asthenia" as essential to the diagnosis of true narcolepsy; cases in which it is absent are regarded as "symptomatic narcolepsy."

The second case is that of a child presenting symptomatic narcolepsy. In this instance also the neurologic examination was negative. A striking feature of this study was the improvement with the administration of thyroid extract in the first case, regarded as true narcolepsy, and the lack of improvement with the same treatment in the case of symptomatic narcolepsy. In conclusion, the author suggests that narcolepsy does not represent a disease entity but that it is a symptom complex depending on injury to a localized brain area.

VONDERAHE, Cincinnati.

PSYCHIATRY AND PSYCHO-ANALYSIS. C. P. OBERNDORF, Am. J. Psychiat. **5**:605 (April) 1926.

The successful treatment of a case of depression with schizophrenic elements is related. In such cases the depth, stability and clarity of insight is the most practical and reliable guide to accessibility and probable cooperation. In addition, the degree of denial of reality and the intensity and reliability of transference determine the advisability of psychanalysis. The patient, a man, aged 33, after a six month period of indifference to work and even distaste for it, lapsed into marked depression with feelings of inadequacy and self accusation; he desired to retire for life to an isolated ranch. Medical and health-farm treatment and rest at home failed. He had long been seclusive, was devoted to indulgence in sexual phantasies, suffered a fear of going blind, wanted to kiss smooth skinned, pink cheeked elderly men whom he met on the street, and suffered from obstinate constipation alternating with diarrhea, stomach ache,

pruritus ani and defective vision. The mother had been committed as insane when the patient was 5, the diagnosis having been dementia praecox; and the father suffered a severe depression at that time. Analysis revealed an effort to take the mother's place with reference to the father in order to make reparation for childish misdeeds, which effort, together with its various implications, explained the symptoms. Complete recovery followed analysis. The author feels that without this form of treatment the patient might well have become a hopeless mental invalid like his mother.

READ, Chicago.

THE TREATMENT OF MULTIPLE SCLEROSIS WITH "BAYER 205" (GERMANIN). A. E. KULKOW, Ztschr. f. d. ges. Neurol. u. Psychiat. **104**:345 (Sept.) 1926.

Multiple sclerosis is one of the diseases in which treatment is extremely unsatisfactory, and also one in which many forms of treatment have been used. The most recent conception of multiple sclerosis, based on the experimental work of many authors (Kuhn and Steiner, et al.), is that it is caused by a spirochete (*Spirochaeta argentinensis*) that is found in the spinal fluid. Arsenic therapy in the form of arsphenamine and its derivatives has been of little avail, however. Kulkow had been working with "Bayer 205" in the treatment of trypanosomiasis and reports excellent results. This, together with the belief that multiple sclerosis was caused by a spirochete, led him to use this drug in the disease.

Of five cases of multiple sclerosis in which the drug was used, four showed definite improvement. In all four cases there was decrease in spasticity and progressive improvement in gait, increase in muscle power, and diminution of ataxic symptoms. In one case vision improved. In three cases retention of urine disappeared. In one case dysarthria disappeared. All the cases treated were of long standing (more than five years). In only one case was the duration one and one-half years. In all cases improvement occurred after from five to six injections. Slight elevation in temperature, albuminuria, in one case an exanthematous rash, and decrease in hemoglobin content were observed.

ALPERS, Philadelphia.

STUDIES IN REACTION TIME. W. W. TUTTLE and L. T. BROWN, Am. J. Physiol. **78**:150 (Sept.) 1926.

In this study an attempt was made to investigate the possible relation between reaction time and skeletal muscle tonus. As an index of muscle tonus the knee reflex was selected, being recorded kymographically in a series of trained subjects during the rest periods between certain exercise schedules designed to bring out variations in tonus. The exercises employed were of three types, stair climbing, rope skipping and knee bending. Reaction time to auditory stimuli was determined by means of a chronoscope immediately following or preceding the recording of the knee reflexes. The observations indicate that during periods of controlled exercise the reaction time is first shorter and then longer, paralleling the occurrence of treppe and fatigue phenomena of the skeletal musculature. The knee reflex responses are at first greater and then diminish in amplitude as fatigue supervenes; that is, in relation to exercise, shortened auditory reaction time appears to coincide with heightened patellar kick response and vice versa. From this the conclusion is obvious that there would appear to obtain some definite relationship between reaction time and muscle tonus. In explanation of this relation the authors suggest either that

tonus is one of the factors controlling reaction time or that both phenomena are dependent for their variation on similar factors of influence.

RAPHAEL, Ann Arbor, Mich.

EXPERIMENTAL INVESTIGATIONS ON THE PENETRABILITY OF MERCURY INTO THE CENTRAL NERVOUS SYSTEM. HANS HOFF, Jahrb. f. Psychiat. u. Neurol. **45**:20, 1926.

(1) Mercurial inunctions in dogs are followed by the penetration of small amounts of mercury into the central nervous system through the meninges. Other methods of administration of mercury, except by the intraspinal method, are ineffective; injection of the metal by the intralumbar route, however, is followed by penetration into the central nervous system, but this occurs only in small quantities, and only when the nerve tissues had been injured previously. (2) In normal dogs mercury penetrates the central nervous system through the cerebrospinal fluid. (3) Mercury penetrates into the central nervous system within eight hours after inunction; as the excretion of the metal is unusually slow, it accumulates in the central nervous system. (4) The administration of purin substances does not enhance the penetration of the mercury; though large doses of iodides hasten its excretion, smaller doses delay the excretion and enhance the penetration of the metal into the central nervous system. (5) Trauma to the liver and intestines increases the penetration of mercury into the central nervous system. (6) Injury to the central nervous system (inflammatory or chronic degenerative processes) facilitates the penetration of mercury. (7) Mercury also penetrates syphilitic tissue, but injections repeated for a long period of time are necessary to kill the spirochetes.

KESCHNER, New York.

PARALYSIS OF RIGHT DIAPHRAGM IN NEW-BORN DUE TO PHRENIC NERVE INJURY. J. E. DYSON, J. A. M. A. **88**:94 (Jan. 8) 1927.

Dyson reports the case of a boy, aged 6 weeks, who when brought to the office weighed 10 pounds 7 ounces, and who exhibited cyanosis on such exertion as crying. He was pale and undernourished. There was a small linear scar in the fold of the neck on the right side and a large forceps scar on the forehead and cheek about the left orbit. Respiration was rapid, labored, and showed marked costal elevation. During inspiration the chest was abnormally expanded in the upper half and in the right lower quadrant. The left side was normally drawn in, but the right side ballooned out with each inspiration. Other details are reported. Roentgenograms showed the diaphragm to be extremely high on the right. At 3½ months, the right diaphragm was not so high. At 6 months, this had become still less, and at 9 months, the child was apparently normal.

Diaphragmatic hernia, congenital heart disease, thymus, cerebral hemorrhage, and injury of cervical roots all were considered in differential diagnosis but were ruled out, and Dyson concluded that there had been a paralysis of the right leaf of the diaphragm caused by accidental injury of the right phrenic nerve. No similar cases are reported in the literature, which Dyson briefly surveys.

CHAMBERS, Syracuse, N. Y.

THE EFFECTS OF MECHANICAL SHOCK ON LOCOMOTION IN AMOEBA PROTEUS. HARRY T. FOLGER, J. Morphol. **42**:359 (Sept. 5) 1926.

Amoeba proteus responds to a mechanical shock by a cessation of movement. A short period intervenes between application of the stimulus and the response. This reaction time varies inversely with the magnitude of the shock. The

ameba remains quiescent for a short time, the period of quiescence varying directly with the magnitude of the shock. A certain amount of time must elapse after a reaction before another can be obtained. If the ameba has partially, but not fully, recovered when a second shock is received, the reaction time is longer than after complete recovery; the period of quiescence, on the other hand, is shorter. A shock that in itself is too slight to cause a cessation of movement may result in the lack of a response to a heavier shock which follows immediately after it, although under other conditions the second shock would have called forth a reaction. If the second shock, however, is made sufficiently heavy, it will bring about a response. This is what would be expected if the reactions take place in accordance with the Weber-Fechner law.

WYMAN, Boston.

NEUROMUSCULAR DYSFUNCTION OF THE BLADDER AS A CAUSE OF CHRONIC PYELITIS IN CHILDHOOD. HENRY F. HELMHOLZ, Am. J. Dis. Child. **32**:682 (Nov.) 1926.

The author reports fifteen cases of neuromuscular dysfunction of the bladder in children. By the term neuromuscular dysfunction, the author understands disturbances of bladder function which are associated with definite clinical evidence of involvement of the central nervous system or of the terminal nerves of the bladder. In this group ten of the cases are of the cord-bladder type, four of the atonic type, and in one there was complete relaxation of the bladder sphincter. The author points out that the prognosis in these cases is poor and that the treatment is difficult, noting especially that the treatment of the complicating infection, chronic pyelitis and cystitis by the usual methods, is practically always unsuccessful.

VONDERAHE, Cincinnati.

INFLUENZA AND SCHIZOPHRENIA. AN ANALYSIS OF POST-INFLUENZAL DEMENTIA PRAECOX AS OF 1918 AND FIVE YEARS LATER. KARL A. MENNINGER, Am. J. Psychiat. **5**:469 (April) 1926.

Of about 200 acute post influenzal psychoses at the Boston Psychopathic Hospital one-third looked like and were labeled dementia praecox. Follow-up inquiries made from one to five years later reveal that of about fifty of these patients that could be traced two-thirds apparently had completely recovered, and certainly only ten who were living showed no improvement. This would seem to indicate the need of new diagnostic criteria or new prognostic conceptions for the acute schizophrenic syndrome. Many illustrative cases described at some length follow, so that the reader may judge for himself as to the nature of the material under discussion.

READ, Chicago.

AN OUTBREAK OF POLIOMYELITIS, APPARENTLY MILK BORNE. A. C. KNAPP, E. S. GODFREY and W. L. AYCOCK, J. A. M. A. **87**:635 (Aug. 28) 1926.

The authors report eight cases of poliomyelitis in one city in all of which the patients were found to have consumed milk from the same dealer; this man obtained the bulk of his milk from a dairy farm on which worked a boy who, seven days previous to the onset of the first case, had been stricken with what proved to be infantile paralysis. Evidence is given to prove that the source of infection was not from nearby or abortive cases, and the cases are presented with a history of the various contacts. Epidemiologic tables are given. While they have little doubt that this outbreak of anterior poliomyelitis is traceable to milk, the authors do not consider this the usual mode of transmission.

CHAMBERS, Syracuse, N. Y.

RELIEF OF DIAPHRAGMATIC TIC, FOLLOWING ENCEPHALITIS, BY SECTION OF PHRENIC NERVES. C. E. DOWMAN, J. A. M. A. **88**:95 (Jan. 8) 1927.

Dowman reports a case showing: (1) rapid spasmodic contractions of the diaphragm following an apparent encephalitis; (2) absence of thoracic breathing in these attacks; (2) production of pain in the scapular region by faradic stimulation of the ipsolateral phrenic nerve; (4) restoration of the respiration to the thoracic type and to a normal rate following division or blockade of both phrenic nerves, and (5) apparent absence of unfavorable symptoms following bilateral section of the phrenic nerves. The author follows the case presentation with a brief comment.

CHAMBERS, Syracuse, N. Y.

DISPLACEMENT OF THE PINEAL GLAND IN HEAD INJURY. H. G. MEHRTENS and R. NETWELL, J. Neurol. & Psychopath. **6**:198 (Nov.) 1925.

In this case of fracture of the left occipital bone, with resulting contusion and hemorrhage of the brain, the roentgen ray showed the calcified pineal gland displaced 0.5 cm. to the right of the midsagittal plane. After the symptoms cleared up and the spinal fluid became clearer, another roentgenogram showed the pineal gland in its normal position. The authors conclude that displacement of a calcified pineal gland may reveal the site of a contusion of the brain before other localized signs appear.

STACK, Milwaukee.

Society Transactions

NEW YORK NEUROLOGICAL SOCIETY AND THE SECTION OF NEUROLOGY AND PSYCHIATRY OF THE ACADEMY OF MEDICINE

Joint Meeting, Nov. 9, 1926

I. Abrahamson, M.D. and Thomas K. Davis, M.D., *Presiding*

A Case of Multiple Dural Neoplasms. Dr. E. D. Friedman.

History.—Helen W., a German housewife, aged 44, who was admitted to Mount Sinai Hospital, Sept. 4, 1926, had had epilepsy since 14, with the attacks at first left sided and later generalized. The attacks had ceased five months before admission. There had been no menses since February, 1926. The present illness began about one year previously, with occipital headache accompanied by a drawing sensation in the neck. Headaches became progressively worse and at times were associated with vomiting. She noted recently that the vision had diminished.

On admission, she complained of diplopia, dizzy spells and occasional twitchings of the right upper extremity. The family had observed that the memory was failing and that she had become flighty. In walking, she would turn her head to the right. Occasionally she suffered from nocturnal enuresis.

Examination.—This revealed: slight inequality of both pupils with a little irregularity of the left; low grade papilledema; slight left facial weakness, and some general paralysis of the right sixth nerve. Hearing was normal, and vestibular tests gave normal responses. There was slight weakness of the left arm and leg, and mild hyperreflexia on the left. The abdominal reflexes were not elicited, but the Babinski sign was not present. There were no definite cerebellar signs in the limbs. In walking, the patient tilted the head backward with the chin directed to the right and the occiput to the left. There was some asynergia of gait and station and a tendency to veer to the right. The visual fields were grossly normal, and there were no disturbances in sensation. She was facetious and jovial. The examination was punctuated by humorous comments on the part of the patient, and she apparently had no insight into the gravity of the illness.

The general medical status revealed no abnormalities. The blood pressure was 100 systolic, 65 diastolic. The urine was normal. The spinal fluid showed only a moderate increase in pressure. The signs pointed both to the right frontal lobe and to the posterior fossa. Ventriculography was attempted, but the patient soon afterward succumbed as a result of paralysis of respiration.

Necropsy.—A postmortem examination revealed numerous smooth, white, hard tumors on the inner surface of the dura. Most of them lay near the midline. They were more numerous on the right side. More than twenty-five such growths were counted. In addition, neoplasms, similar in character, were present on the inferior surface of the right tentorium, in the region of the right pontofacial angle and on the posterior margin of the foramen magnum. All of these apparently took origin from the inner surface of the dura; they did not infiltrate the brain. The surface of the brain presented evidences of

increased intracranial pressure. In the right frontal region near the midline and extending to the mesial surface of the hemisphere was a large area that was soft, friable, and discolored — apparently degenerative in character, and containing free blood in its depth. The right cerebral hemisphere was swollen about this region and produced a concavity on the mesial surface of the left frontal lobe, the result of pressure. This mass was not adherent to the overlying meninges. The floor of the third ventricle was thinned out and bulging. There was evidence of a pressure cone of the base of the cerebellum. An area of erosion of the inner table of the skull in the right frontal region was present.

The postmortem diagnosis was multiple endotheliomas of the dura, with a large area of softening and degeneration in the right frontal lobe.

DISCUSSION

Dr. J. H. Globus: The specimen is indeed uncommon, and, as such, is of interest mainly to the pathologist. Clinically, a specimen of this sort is not especially instructive because the signs and symptoms arising from such a multiplicity of tumors give no opportunity to identify or localize the lesion. Multiple tumors of this sort are easily confused with inflammatory lesions of the brain. Pathologically, it is probable that specimens of this type will throw light on the origin of endotheliomas, and will test the explanation suggested by Cushing for their origin. He believes that endotheliomas are misplaced embryonal rests of the arachnoid, carried away into the dura and there giving rise to tumor formation. For this reason he names such neoplasms meningiomas. In this case, among the many dural nodules, one was found extending into the frontal lobe. The specimen leads one to believe that the explanation of Cushing is correct.

Dr. J. Ramsay Hunt: Some years ago, in my study of tumors of the acoustic nerve and neurofibromatosis, I encountered the association of multiple fibroid tumors of the dura mater with general neurofibromatosis. In the literature, a similar association has been recorded although the occurrence is rare. The pathologic appearance of the dura was exactly the same as in Dr. Friedman's case and was limited to the dural covering of the brain; it did not extend into the spinal canal. At the time, some consideration was given to the possible origin of these tumors in the nerve supply of the dura mater; in other words, it was thought that the condition was a dural neurofibromatosis, and in a few of the tumors medullated nerve fibers were demonstrated. It might be well to consider this possibility in future pathologic investigations.

The Changing Manifestations of the Neuroses. Dr. I. S. Wechsler.

The observations that I have to make are not altogether novel and the explanations are perhaps not quite correct, but I venture both in the hope of criticism and discussion. When one looks over papers and textbooks, even as recent as the revised edition of Oppenheim's work that appeared in 1924, one finds considerable attention devoted to manifestations of the neuroses which now are never seen: hysterical hemiplegias, other paralyses, aphonias, astasia-abasia, and all sorts of conversion signs. Such cases were seen frequently by older observers. It would be comforting to think that present-day neurologists are the better diagnosticians, but it is not quite true. Men of the type of Charcot, Moebius, Weir Mitchell and Binswanger were accurate observers, and they undoubtedly saw manifestations of the neuroses that are not seen today. And I have proof that they were right. If one takes the first

quarter of this century, in which few of the hysterical paralyses have been observed, he finds one island of time wherein tens of thousands of patients showed just those symptoms. I refer to the World War. During that period, whether it was the phlegmatic Englishman, the stolid German, the volatile Frenchman, the somber Russian, or the composite American, all showed hysterical palsies, stammering and blindness. It is evident, therefore, that those hysterical manifestations can and do occur, though they are not seen in civil practice.

My observations are based on experience at the Vanderbilt Clinic, which has a yearly admission of about 2,000 patients, on work at the Mount Sinai Hospital and Dispensary, at the Montefiore Home and the Central Neurological Hospital, the last two of which have patients with chronic cases. Among the thousands of patients seen personally, I recall only one case of hysterical convulsions such as are described by Charcot, one or two hemiplegias and monoplegias, and a few aphonias. The question is: Why are they not seen? What has happened in so short a time, or has anything happened at all? It seems to me there must be some explanation.

If one looks on a neurosis as an attempt at adjustment, and if he accepts the opinion that a neurosis is the result of a conflict, then he must concede that both the older and the more recent manifestations are attempts at adjustment. What are seen are anxiety neuroses, phobias, so-called neurasthenias, compulsion neuroses, maladjustment cases and borderline types. The former may be designated as low somatic types of adjustment, and the latter higher psychologic types. Both are the results of conflicts and attempts at adjustments that the patients must make in order to hurdle life's difficulties.

I think it is conceded by many that religion (by that I do not mean the philosophic or speculative aspects but the ceremonial and ritualistic forms) represents in a measure a neurosis that is accepted and condoned by society. When a person makes the sign of the cross, puts on phylacteries or salaams to the east he does exactly what the compulsive neurotic does when he goes through his ritual, fixing his pillow, counting numbers, or doing certain things, with this difference, that the social compulsive act is not in conflict with the social group. In religious ritual the neurotic person has an outlet for the neurosis; he need not get into conflict with society by begetting a neurosis. The Jew putting on phylacteries in the synagogue is considered sane; let him do it in the street, and he would probably be apprehended as queer. Religious ritual, then, offers an outlet for individual neuroses.

A Catholic girl who is disappointed in love takes the veil and enters a convent, thus marrying her ideal and escaping an individual neurosis because she loses herself in a social neurosis. The same procedure suddenly followed by a Mohammedan, Jewish, or Protestant girl would arouse grave suspicions as to her sanity. Throughout the ages, waves of religious movements (tarantula dances, flagellations, crusades) expressed themselves in hysterical manifestations. To this day in this country are held epidemic or endemic revivalist meetings, in which whole communities find hysterical outlet. It may be observed that the loud, hysterical shrieks that fundamentalist ritualistic fervor employs against modernism are only the signs of helplessness in a losing fight, of infantile neurotic reactions in the face of advancing reality. They may insist on erasing evolution from textbooks; their fight is only the last gasp before the avalanche of knowledge that is coming to overwhelm reaction.

It may be asked if my observation is correct. Can it be that one generation has brought about such a change in the manifestations of the neuroses?

Even if the period of recorded history only is reckoned, almost a hundred generations, what does one generation amount to? It is possible that the intense and rapid diffusion of knowledge in recent years, the familiarization with scientific facts, the spread of the knowledge of evolution and the weakening of religious ritual have tended to mature the sense of reality and have gradually prevented the widespread infantile, low-level types of reaction to conflicts arising from the struggle for adaption. A child will express his displeasure in the face of conflict by kicking or screaming, but the adult no longer can adopt the same method. This may be one explanation; but I should like to offer another, perhaps even more theoretical and philosophic: A neurosis is the penalty one may pay for growing up, or for the unsuccessful attempt to grow up. The adult state is bound up with many difficulties. Those who cannot hurdle the difficulties will react with neuroses at some time. This is seen at puberty, in adolescence and in social and love life. The neurosis represents the attempt at adjustment, the failure in the conflict and the flight from reality.

Is it possible that groups, like individuals, go through the same stages of development? May one say that phylogenesis repeats ontogenesis, the reverse of what happens in general organic life? Before developing this point I shall cite a few statistics from the records of patients admitted to the Vanderbilt Clinic in the last few years. Fifty-five and a half per cent of the total number of patients admitted to the neurologic department presented neuroses. The colored population of the clinic showed only 29 per cent of neuroses. This may be compared with the incidence among American negroes and British West Indians. The British West Indian negro is more intelligent, better educated and socially superior to his American brother. The American negro shows 27.5 per cent of neuroses, and the British West Indian negro 35.5 per cent. The negro with better opportunities and perhaps a little more freedom has developed neuroses to a greater extent.

Does the group necessarily develop neuroses in its march upward? I know neither the incidence or types of neuroses among the Japanese and Chinese, nor do I know whether neuroses exist among primitive peoples. A priori, I should say that there can be no neuroses among primitive people, because their whole social existence is a neurosis, an infantile reaction to life. The group spirit and the force of taboo is so great that there is no possibility of revolt. One cannot transgress social usage or taboo in primitive society without incurring the punishment of death. Only civilized man can afford the luxury of a neurosis. I do not know whether my speculations apply to all groups. I am merely wondering if one can speak of a neurosis as a manifestation of the group in its march up the scale of civilization or as a manifestation of the individual in his growth up the tree of life.

Occasionally a neurosis is the revolt against the social hypocrisy that forces people into ways of living to which they cannot possibly accustom themselves. Sometime I shall write an essay entitled "In Praise of Hypocrisy," with apologies to Erasmus' "In Praise of Folly." It seems that the very violence with which the social group reacts to the hypocrite betokens a defense mechanism on the part of all of us. It is possible that diffusion of psychanalytic knowledge, the realization of the mental mechanisms constantly at play and the influence of the psychology of motivity on human thought and action will affect our methods of adjustment. Thus far it is premature to say that it has affected behavior. Besides, the subject of psychanalysis is too vast for a discussion in this connection; here I would merely hint at it.

SUMMARY

I wish to repeat the observation that the classic types of neuroses are not seen; the older types are low-level or somatic reactions, and what are seen today are higher, psychologic manifestations. Only the methods of adjustment have changed, not the reactions of the individuals or the need for neuroses. If anything, the conflicts have become more intense, the needs for neuroses greater and the social casulties more numerous.

DISCUSSION

DR. LOUIS CASAMAJOR: Dr. Wechsler has brought out many interesting points in regard to the neuroses as they are seen today. Those who have been working with neurologic material for a number of years have noticed a change in the neuroses, and neurologists all have felt that the old hysteria of Charcot, with the conversion paralyses and the anesthesias, is disappearing. It has not been understood altogether what this meant, and it is not understood today, because it is not altogether true. Certainly in the days before the war one did not see much of the anesthesias, the paralyses and the conversions, the things that Dr. Wechsler calls the lower levels of the neuroses. During the war, in the primitive conditions in which man found himself, many of the older types came back. After the war, again one saw a tendency for the neuroses to return to the higher levels of expression, but new elements began to come in; the element that tended to bring the neuroses back to the lower levels seemed to be principally that of compensation, and the neuroses that one sees today seem to be restricted almost completely to those which arise as the result of the Workmen's Compensation and Veterans' Bureau laws. I invite anyone who wants to see the neuroses of twenty years ago to go to the Veterans' Hospital, where he will see all of them; it would appear that the element of compensation has done something to bring out that type of neurotic expression. What Dr. Wechsler has said about the education, culture and civilization of the individual has a great deal to do with the type of neurotic expression. Probably the lowest type of neurotic expression is a conversion. That is probably the easiest one to manifest itself, and it is certainly the most common. If one would attempt to compile a series of neurotic symptoms, I think paralysis would come as the lowest. Then would come the anesthesias and so on up through the anxieties to what may be the higher levels for the neuroses, at which one can place the phobias and compulsions. However, I do not know that things are changing much. In reality, it takes little to bring the neurotic person down to a lower level, and while there is much of what can be considered as the higher types of neurosis, many of the lower ones exist.

Practically all of my medical life I have been connected with the Vanderbilt Clinic, in which twenty years ago few neuroses were seen among negroes. Most of the negroes lived then in small groups and a great number of them resided in the "San Juan Hill" district of New York City, in primitive conditions. Following the war the percentage of neurotic negroes increased, and this increase was chiefly among the British West Indian negroes. I feel that this change is due principally to the alterations that have taken place in the negro's living conditions when he moved from small, simple communities, such as that of the "San Juan Hill," to that larger negro city in Harlem, with its own customs and civilization, and with their reaching out for personal and racial expression of some sort, while surrounded by a white civilization with which they are in competition. This has brought on these still primitive people cultural standards three or four stages ahead of the previous generations. They

may try to adjust themselves to these conditions by means of neurotic difficulty in about the same way that the white man does.

Dr. Foster Kennedy: Dr. Wechsler's thoughtful and provocative discussion is hard to criticize and discuss. It has been nearly seventeen years since I came from a large European clinic to work with an equally large American clinical material. I was surprised to note the absence here of many examples of constructive conversion hysteria with which I had been entirely familiar in London. My associates and I were never, in Queen Square, without from two to six cases of hysterical hemiplegia, one or two cases of hysterical blindness, and at least one case of hysterical aphonia was always to be seen. I think that in the Neurological Institute in New York and on our service at Bellevue Hospital such cases are rare; they were just as rare seventeen years ago. I do not think that any particular change is taking place in the neuroses in America, at least in the time I have been seeing American clinical material. There is a difference in the reactions here and those that take place in Europe, which occur, I think, equally in Germany, France, England and Italy. Dr. Wechsler tried to give a reason for this. His reasons are plausible, but I do not know whether they are sufficiently sound. He assumed that the conversion hysteria is a more primitive and more somatic reaction than is a generalized phobia. That catches the eye, but it may not be true. In France, I remember differentiating in my mind the soldier with a generalized neurosis, a generalized defense reflex condition in an organism given over to only one emotion, fear; the officer, who, with too much conscience and striving too hard to do his best, was neurotic about his responsibility toward his men and broke down thereby. Usually it was the Tommy, I think, rather than the officer, who, having been hit with a bit of flying earth, sustained an hysterical paralysis of the arm, which he thought for a moment had been blown off. Perhaps a medical officer suggested then that he had a brachial palsy, and the idea put into the man's mind gave him a paralyzed arm. I used to call this "localized suggestion." One result was a breakdown of the man's whole emotional nature. The other was a conservation measure of his emotional nature. The man who had hysterical paraplegia was never unhappy emotionally. He was in the same position as the wounded man, and the wounded man was not neurotic. The man who had a wound sufficiently severe to solve the problem of the war for him was not neurotic. The man who succeeded in getting a paralysis of the arm by suggestion given to him from without, by a slight wound or a bit of flying earth hitting him, or the badly directed verbal suggestion of a medical officer, was in precisely the same state as the wounded man, and was not unhappy; so conversion hysteria is a method, inadequate if you will, of getting over one of those hurdles that Dr. Wechsler spoke of as confronting every person who reaches adult life. One may find that the hurdle is too big; he balks at it; he cannot get over the five-bar gate. One way of explaining to the world the inability to get over that hurdle is to say that one is paralyzed, and that by reason of that paralysis it is not necessary to tackle the difficulty, and one is free of his obligation to get over that hurdle. If one does not get that suggestion, if he cannot convince himself that he is paralyzed, or cannot accept the suggestion of another that he is paralyzed or aphonic, or in some way get out of the difficulty, then he may develop a phobia. I remember a woman who had a phobia that she could not get into a ferry or a motor car; her leg had been injured in an automobile accident. On that slender substructure, she erected a complete hysterical paraplegia. While she had this paraplegia, she was

happy emotionally. Her fears were relieved. When she was cured of the paraplegia, the phobias returned. I think that conversion hysteria is a fairly adequate attempt on the part of a weak nervous system to cope with the difficulties of life, and the American does not accept a suggestion as readily as the European. At least, he did not accept it when I saw him seventeen years ago any more than he does today. Dr. Wechsler interested me when he said that the more intelligent the person is, the more neurotic. I should like to ask him what he meant by the more neurotic. Does he mean more fearful, more tremulous, more given over to ritualistic observances, or does he mean that conversion hysteria is more common?

Dr. Casamajor's statement that compensation can produce conversion hysteria of the type with which all physicians were familiar in Europe is another example that, by properly directed suggestion, conversion hysteria will be produced, and suggestion will produce the necessary paralysis and blindness. All of us at times were "scared stiff" in the war, and if one could have gotten rid of the war in some way compatible with his dignity as a human being, he would have been glad to have done so. The person who, by getting hurt in a railroad accident, sees an opportunity to sue a rich corporation against which he feels a grievance has a basis for a conversion hysteria that the ordinary person does not have.

Dr. J. Ramsay Hunt: A few years ago, Dr. Dana and others in this country wrote on the subject of "The Passing of Neurasthenia," a disease that was described by Beard and that has sometimes been called the American neurosis. What these writers meant was not that neurasthenia had died, but simply that neurologists had come to look at it in another way. They had acquired a much deeper insight into this condition and its causes and relations to other disorders. While neurasthenia lost some of its importance as a disease, it gained immensely in the better understanding of it as a syndrome. This, it seems, has taken place with the psychoneuroses in general, and one must bear in mind his own changed point of view and his increased knowledge of these disorders, especially of mental mechanisms and the important psychic aspects of this great field.

In this country, the conversion hysteria of the gross somatic type has always been comparatively rare as compared with France, and there is little doubt that this group was overemphasized by the French school in Charcot's day. Now, neurologists do not attach so much importance to these somatic forms, as they are interested more particularly in the deeper psychic mechanisms in these cases. This removes a potent suggestive factor, which undoubtedly was active in the Charcot school.

Dr. Wechsler's paper is interesting in suggesting that the psychoneuroses, which are, as it were, a by-product of civilization, change with the evolution of society. While this may be true, I think that the lapse of time which is applied as having caused a change is far too short to have had any material effect on this group of disorders. I would ascribe the apparent change rather to the progress that medicine has made in the last decades and the rapidly shifting point of view in the conception of the psychoneuroses. It is here that I would look for the apparent change in the natural history of the neuroses rather than in the psychic and somatic manifestations themselves.

Dr. Wechsler: The war neuroses differ in one fundamental respect from the peace neuroses. A war neurosis represents essentially an ego neurosis. The mechanism is the same as in the peace neuroses, but the neurosis is not of the same type. In war one found an individual who had a sense of patriotism,

loyalty, honor and *esprit de corps.* He could not possibly escape or revolt against them. The ego or instincts of self-preservation were involved; therefore, it was a definite ego neurosis and was not on a psychosexual basis as the peace neuroses were. The latter are rooted in the person all the way back to his childhood. One may accept this even if he would not accept the freudian explanation in toto. If a man past 40, who has never been neurotic before, presents a syndrome of neurasthenia or other neurosis, one generally looks for tumor of the brain, general paralysis or cerebral arteriosclerosis. Few men develop neuroses suddenly, though everyone is capable of reacting with a neurosis if the conflict is sufficiently intense. In the peace neuroses, then, one can find traces all the way back to childhood. Of course it is possible that the men who developed neuroses in the war would have developed them in peace, but I think the neurosis is of a different type. Most observers during the war recorded the fact that officers were subject to different types of neurosis than the ordinary soldiers. It was the officers who developed the phobias and anxieties or the higher psychologic reactions. The plain soldier reacted with a conversion symptom or a low somatic neurosis.

The question of compensation, too, I think could be divided into two parts. What Dr. Casamajor says is true, but the following may serve as an explanation: One may find in an industrial accident an unconscious excuse for getting out of a difficulty with which one was confronted in life. A man may have a horrible home life, the accident merely serving as an excellent excuse for getting out of the situation. Of course, if he does this consciously he comes dangerously near the malingering class. The other type, the true traumatic neurosis, may possibly be considered as an actual or ego neurosis.

The question of whether the more intelligent a person is the more neurotic he becomes is hard to answer. I believe that horses do not have neuroses. One has to have a certain amount of brains to have a neurosis, a definite layer of consciousness, a certain depth to the unconscious mind and a fair degree of intelligence. It is true that one sees hysterias in mental defectives, but I do not think that an anencephalic person can have a neurosis. He does not have anything else either, for that matter. To infer that the American is more intelligent than other people would be flattering to us, but the League of Nations probably would be in arms against us for saying it. A certain degree of intelligence is necessary for a neurosis. It is curious that compulsion neuroses, or the highest psychologic types, are most common among highly intelligent people.

It probably is so with regard to neurasthenia. As. Dr. Hunt has said neurologists as diagnosticians have changed and not the neuroses. The reason is that the concept of neurasthenia has changed. Formerly, everything for which there was no name was included under it. Psychasthenia was taken out of it and made a separate entity, and so was anxiety neurosis and anxiety hysteria. Neurasthenia has disappeared, not because observations are faulty, but because methods have changed. As I said, the method of adjustment has changed, not the need for neuroses. Dr. Kennedy's remark that the American has a different method of reacting may be true, but why does he have that? To say that we are different psychologically is obviously not quite true. What is different is our environmental situation. Unfortunately I have no experience with other peoples, and so I can hardly make comparisons. It would be interesting, however, if some one could take up anthropologic studies with regard to the neuroses and also could investigate the influences of religion on the neurotic behavior of various groups and in various countries.

CHARLES BATES DUNLAP, A.B., A.M., M.D., 1862-1926

Dr. Charles Bates Dunlap, a member of the New York Neurological Society, died suddenly at his home in Scarsdale on June 6, 1926, in his sixty-third year. Although it had been known for some time that Dr. Dunlap was not in good health, it was not believed that his condition was serious. In fact he was in his laboratory on Saturday at work as usual, but on Sunday morning he was seized with an anginal attack and died about noon of that day.

Dr. Dunlap entered the New York State Hospital Service on April 19, 1902, when he was appointed chief associate in neuropathology by Dr. Adolf Meyer, then director of the Psychiatric Institute. During the following twenty-four years, through his work at the institute, his scientific contributions and his discussions at society meetings, he became widely known to all laboratory workers and was recognized as one of the outstanding figures in neuropathology in this country.

Dr. Dunlap was born in Cambridge, Mass., Aug. 24, 1862. His boyhood was spent in West Virginia, which had been the home of his family for many years. He returned to Cambridge to complete his education in the high school and later entered Harvard University, where he was graduated, in 1889, with high honors, receiving both A.B. and A.M. degrees. He then began the study of medicine in the Harvard Medical School and received his doctor's degree in 1893. He secured an internship in the Boston City Hospital, following which he was appointed first medical house officer of the hospital and in this capacity served several years. On finishing his general hospital experience, Dr. Dunlap began his training in neuropathology at the McLean Hospital Laboratory, where he worked with the late Dr. August Hoch. In 1886, he was appointed by Dr. Meyer as assistant in neuropathology at the Worcester State Hospital, and when Dr. Meyer went to Ward's Island, in 1902, he invited Dr. Dunlap to take charge of the neuropathologic laboratory of the Psychiatric Institute. In addition to his work at the institute, Dr. Dunlap became instructor and finally professor of neuropathology at the University and Bellevue Medical College, which position he held at the time of his death.

Dr. Dunlap's scientific contributions cover many important problems in the field of neuropathology. He was among the first in this country to take up and confirm the important observations of Nissl and Alzheimer on syphilis of the central nervous system, cerebral arteriosclerosis and senile atrophy of the brain. An important paper, entitled "The Anatomical Borderline between the So-Called Syphilitic and Meta-Syphilitic Diseases of the Brain and Spinal Cord," was published in 1913. Another paper on this subject, "The Pathology of General Paralysis," was published in 1914. Following the epidemic of encephalitis in 1918, Dr. Dunlap devoted considerable time to the study of this disease and contributed a paper on "Brain Changes in Lethargic Encephalitis," which was published in 1921.

For a number of years Dr. Dunlap spent a great deal of time on the study of the pathology of Huntington's chorea. He collected and worked up a most valuable material on this subject and made a number of preliminary communications. Fortunately, his work on chorea was nearly complete at the time of his death, so that it will be possible to publish at an early date his comprehensive study of the pathology of this disease.

Dr. Dunlap for many years was interested in the subject of the changes in the brain in dementia praecox. He spent a great deal of time on the study of the cerebral cortex in this form of mental disorder. While he believed that there was probably an underlying structural foundation for this psychosis, yet

he was never able to confirm the discoveries of others who claimed to have discovered changes in the brain in cases of dementia praecox. Dr. Dunlap showed, through the study of suitable pathologic material and control cases, that the reported lesions in dementia praecox could not be regarded as typical or specific for this type of mental disorder. His last paper on this subject, "Brain Changes in Schizophrenia," was presented at the Meeting of the Association for Research in Nervous and Mental Diseases, December, 1925.

Dr. Dunlap possessed qualities of intellect and temperament that stamped him as a true scientist. His contributions, conclusions and opinions were highly valued and always respected. He was a most careful and conscientious worker; he made no hasty deductions; his methods of work, his technic, his painstaking efforts, clear thinking and good critical judgment all combined to inspire the fullest degree of confidence in whatever results he obtained in his investigations.

He was particularly successful as a teacher of neuro-anatomy and neuropathology. He had the rare ability to present the difficult subject of anatomy of the central nervous system in a simple and most attractive manner. By using plain language and helpful illustrations, he could make a complex subject interesting and easy to grasp; his grateful students always treasured his lecture notes on neuro-anatomy as one of their most valuable possessions.

Beneath a quiet and dignified exterior, his friends found a lovable and kindly disposition combined with a keen sense of humor and a remarkable insight into human nature. He was a man of simple tastes who disliked display and ostentation in any form. His students and colleagues always found him sympathetic and interested in any problem that they brought to him for advice or help. He was affectionately regarded by his associates, with many of whom he established strong bonds of friendship. They recognized in him a teacher and investigator of unusual caliber, one whose sincerity and devotion to duty and high scientific ideals were a constant stimulus and inspiration to all who came under his influence.

Our society has lost one of its outstanding members, a fine character, a student and a scientist, whose life and work were a credit and honor to the profession, to the medical school with which he was affiliated and to the state institute to which he dedicated so many years of useful service.

CHICAGO NEUROLOGICAL SOCIETY

Regular Meeting, Nov. 18, 1926

JOHN FAVILL, M.D., *President, in the Chair.*

TRAUMATIC INTERNAL HEMORRHAGIC PACHYMENINGITIS, WITH TUMORLIKE CLOT. DR. PETER BASSOE.

A girl, aged 14, came to the hospital after five weeks of headache, photophobia and increasing weakness and emaciation. About three weeks before admission she had a generalized convulsion, with unconsciousness and involuntary evacuations. There had not been any previous illness. The neck was stiff, and a slight Kernig sign was present. The right pupil was twice as wide as the left. On account of the long duration of the condition, tuberculous meningitis was suspected. During the night the patient cried out with pain in the head three or four times every hour. Lumbar puncture was made in the

morning, with the patient lying on the side. The pressure was 140 mm., and it rose about 30 mm. on jugular compression. This, together with a normal condition of the optic disks, was assumed to rule out a block. The fluid was turbid, with 6,500 cells, 99 per cent of which were polymorphonuclears. Organisms were not found in the smears or in subsequent cultures. On account of the turbid fluid, 20 cc. of meningitis serum was injected at once. The patient immediately became cyanotic, but the pulse remained strong. She did not make any further respiratory efforts, but artificial respiration was maintained and the heart continued to beat for six hours.

At necropsy a purulent inflammation of the right frontal sinus, with osteomyelitis of the frontal bone, inflammation and adhesions of the dura, and a large abscess in the right frontal lobe were found. General meningitis was present, but the exudate was not thick. *Streptococcus viridans* was obtained in cultures from spinal fluid secured at necropsy and also from the abscess. The pus was foul and in smears showed a gram-positive bacillus.

The sequence of events seems to have been: A cold, frontal sinusitis, osteomyelitis of the skull, pachymeningitis, abscess of the frontal lobe, meningitis, increased intracranial pressure, lumbar puncture, sudden descent of bulb, and paralysis of respiration.

FRONTAL SINUSITIS, OSTEOMYELITIS OF SKULL, BRAIN ABSCESS, MENINGITIS, LUMBAR PUNCTURE AND SUDDEN DEATH. DR. PETER BASSOE.

During a severe storm on Jan. 11, 1926, a previously healthy farmer tried to keep a barn door from blowing down. A hayrick fell on his right shoulder and knocked him over so that the left side of his head struck an iron roller. He walked into the house an hour later and evidently had been dazed and perhaps completely unconscious, but no one had seen him. Afterward he complained of pain in the head, but kept on working until about ten days prior to my examination on August 8. A physician who had been called ten days previously had found him drowsy and unsteady, dizzy at times, with a pulse rate of from 45 to 50. He became more and more stuporous and had involuntary evacuations. The right arm became weaker than the left and occasional twitchings were noticed on the right side, but real convulsions did not occur. He did not vomit or complain of headache. I found the right disk normal, the left slightly blurred. The pupils were normal. There was a bilateral Babinski sign. The knee and ankle reflexes were increased; the right cremasteric reflex was less active than the right, and the abdominal reflexes were absent. Sensation and fields of vision could not be tested because of stupor. Lumbar puncture yielded a clear fluid under increased pressure, which was normal to all the usual tests. I advised exploration of the left hemisphere if the patient did not improve. Soon after the puncture, however, he became so weak that the surgeons did not dare risk an operation. The weakness of the left side increased, and the patient died on August 14.

At necropsy, on the top of the left hemisphere and covering its anterior two-thirds was a flattened, bluish sac which resembled a slightly distended rubber hot water bottle. It evidently was formed under the dura mater and was the result of gradual or repeated hemorrhage. It naturally resulted in gradually increasing pressure, as a meningioma would have done. Its upper surface showed the markings of the vessels of the dura and the grooves of the skull. It looked like an organized growth but in reality was only a slowly formed clot, the result of traumatic so-called "pachymeningitis hemorrhagica interna."

THE PATHOLOGY OF AMYOTONIA CONGENITA (OPPENHEIM). DR. ROY GRINKER.

This article will be published in a later issue of the ARCHIVES.

THE VALUE OF PERIMETRY IN THE DIAGNOSIS OF CEREBROSPINAL LESIONS. DR. D. M. OLKON.

Last year at a meeting of this society I related the case of a girl, aged 15, who complained of failing vision, and who presented no neurologic signs or symptoms other than primary optic atrophy. Through perimetry, compression of the optic chiasm was suspected and was corroborated at operation by Dr. Harvey Cushing who found "a hard tumor" in the chiasm.

The case I am reporting is that of a man, aged 46, a carpenter, who sixteen years ago first had severe pain in the lower lumbar region; the pain came in attacks that lasted from one to several days and recurred every three or four months, incapacitating him for work. The remissions and exacerbations continued for about four years, when the pain disappeared until eight years ago. He then had "malaria and yellow fever," which lasted about four months. He also had "flu" in the same year which lasted about a week. Shortly after, he had severe pain in the right knee with slight swelling to one side of the patella. At the same time the right ankle would "give 'way" occasionally, almost throwing him to the ground. Pain in the knee and foot increased until he had to use crutches. After about eighten months, the pain became less and he returned to work. Three years ago, the left foot began to pain and to "give 'way." Walking became difficult because the limbs were "gespannt and tense" and locomotion was slow. Paresthesias developed in various parts of the upper extremities, more pronounced in the right arm and in the neck, and the right foot felt as if there were a cotton pad under it.

Eighten months ago, he was given five intravenous injections of "some yellow powder." Two days after the last injection, on getting out of bed, he had a convulsion and became unconscious. The face turned to one side, he foamed at the mouth and bit the inside of the right cheek. Two hours later, while at breakfast, he had two similar convulsions, each lasting about two minutes. There were no after-effects, and there have been no convulsions since.

Neurologic examination reveals: absence of abdominal reflexes; exaggerated knee and Achilles reflexes; foot clonus—sustained on the left, not on the right; Rossolimo and Mendel-Bechterew signs on both sides; Meyer's phenomenon in the left thumb; fine tremor of the tongue; absence of cremaster reflex on both sides; hypesthesia in the right sternocleidomastoid and deltoid regions; a peculiar stiffened gait, not spastic nor ataxic. The plantar reflexes are of flexor type, and the neurologic examination otherwise reveals nothing abnormal, except that there are occasionally two or three nystagmoid jerks of the left eye when in the extreme temporal position and in the horizontal plane.

General examination has not revealed any abnormalities. The spinal fluid was clear, under normal pressure, and contained four cells; the Nonne-Apelt and Pandy reactions were negative. The Wassermann reaction was negative with both blood and spinal fluid.

The ophthalmic examination, reported by Dr. Hallard Beard, ophthalmologist, revealed: Central vision corrected, right 1.5-1; left, 1.5; immoderate amount of compound hyperopic astigmatism. No lesion has been noted in either fundus at any of the several examinations since the patient was first seen, Oct. 23, 1926. Visual fields, taken Nov. 13, 1926, show an almost concentric contraction in each eye of from 10 to 30 degrees, rather more in the right eye and in the temporal fields, which are somewhat more restricted than the nasal fields.

The neurologic signs are not characteristic of any particular disease entity. The perimetric examination, however, linked with the positive neurologic signs, give a definite clue to the diagnosis. Notwithstanding the absence of classic signs and symptoms of multiple sclerosis, the combination makes the diagnosis of that disease practically certain.

THE ROHRSCHACH TEST IN RELATION TO THE PSYCHOSES. DRS. HARRY A. PASKIND and DAVID M. LEVY.

In 1921, Herman Rohrschach reported a new perception test to which he attributed considerable diagnostic significance. The test consisted of the interpretation of forms that were created by pressing down the middle of a sheet of paper on which blots of black and colored ink had been placed previously. The materials of the test consist of ten figures. The technic is described by Rohrschach as follows: The subject is given a figure and is asked, "What can this be?" He is allowed to turn the picture at will, and it may be held at any distance shorter than the length of the outstretched arm, as Rohrschach determined that a response given at a greater distance than this makes subsequent replies unsatisfactory. It was found impractical to fix a reaction time. The test should be free from coercion, but if one response is given and the subject appears unable to give another it is allowable to say, "Most people give two answers."

Rohrschach found variations in the numbers of responses given, but he did not attach special significance to this. It was found, however, that normal persons give between fifteen and thirty answers for the series. In abnormal persons the number of responses depends on the clinical condition. Irritable, stubborn, depressed patients often give only ten replies. Amiable, interested subjects are liable to give more than the average number of answers but many of the replies will be similar. Feebleminded, epilepsy and manic patients may give a high average number of responses and patients with organic disease and melancholia a low average number. Schizophrenic patients vary. Shut-in, indolent patients may give only ten, while orderly patients give the average normal number.

After all the responses have been recorded, each reply is analyzed with the following factors in view: (1) Is the interpretation based on the entire picture, a large part, a small part, or a blank space? (2) Is the answer determined by form, color, a combination of form and color, or is the answer one in which kinesthesia plays a part? (3) Is the reply a sharply or vaguely perceived image? (4) What is the object named in the response. (5) Is the response one that is common or rare? Those responses encountered in one of three subjects are considered common, those encountered not oftener than once in 100 subjects are called original. (6) As to the type of perception, does the subject show a tendency to interpret the entire figure first and then give fragments in his subsequent responses, or vice versa? Or is there a tendency to react at first to details and in subsequent responses fragments of these details, or vice versa?

Rohrschach found that patients with different clinical conditions react differently to the test, and in this difference lies the diagnostic significance of the procedure. He developed different values for the various psychoses, and these values are considered so constant for the condition that a differential diagnosis may be based on them. In our study of 100 cases we found different and constant values in each psychosis, but our results vary somewhat from those of Rohrschach. This variation may be partly explained by racial differences, as Rohrschach's patients were Swiss and ours American.

DISCUSSION

DR. JULIUS GRINKER: Dr. Levy spoke of dilatation of the personality after psychanalysis; was there also a clinical improvement in the patient?

DR. LEVY: Yes. When I said successful analysis I meant there was clinical improvement and that was used, therefore, as a check as to whether the analysis was successful.

DR. CLARENCE A. NEYMANN: This dilatation of the personality, as Dr. Levy says, is important; every one will agree that the successfully analyzed person develops more vital interests in life. They express themselves in more complete forms; they have more originality and are not so self-centered. This, therefore, would seem to be a legitimate follow-up of the facts observed clinically. A person who is only able, as in the case of the psychasthenic, to talk about pins, the fear of pins, etc., gradually widens his personality, and his scope of general interest in life likewise grows as the analysis progresses. There is one thing that might profitably be done in the tabulation of these symbols. The present arrangement seems too cumbersome. I must say that I was mystified by the presentation because of the employment of German terms and signs. For instance, why can we not use c. or col. for color? More definite tables probably could be worked out by Dr. Levy and Dr. Paskind so that the survey would be easier for the ordinary clinician.

DR. JOHN FAVILL: Will Dr. Levy tell us more in detail the exact formula of instruction to the patient when starting the test? As is known, in the Stanford-Binet test, there are precise forms of questions necessary for the proper giving and scoring of the test. Dr. Levy gave me this test some time ago and my first thought was, "What type of observation am I expected to make? Is it the general effect of the whole picture, or is it the details?" I think the same thing must occur to many persons who take it.

DR. PASKIND: I agree with Dr. Neymann that it is desirable to simplify this test in some way, but the multiplicity of details makes simplification difficult. We used German abbreviations because most of the literature is in German and the one article in English also uses German symbols; we found their continued use convenient for comparison. In cases of insanity we sometimes find that the patient does not realize that the figures are bilaterally symmetrical. Whether that correlates with poor intelligence or indifference I am not prepared to say.

DR. LEVY: In reply to the remark about the use of German terms, we are checking these against tables in which the abbreviations are always in the German. As soon as we have American tables that will not be necessary.

Regarding the further work, there are five research groups in different parts of the country already working with Rohrschach material. That will enable us to get normal standards, to work out equivalent tests and, if possible, to simplify the problem of individual interpretation. The test is given in this way: The patient sits in a chair away from the desk so that he cannot place the card on it, and in that way is able to move the card as he pleases. He is shown some pictures and is told, "Tell me what this can be? What can it be?" If he makes only one response he is told that most people see more than on thing. If he gives more than five he is stopped merely by withdrawing the picture. It has been found by experiment that more than five responses per picture are of no more value than ten, so the limit of five saves an immense amount of time.

DR. A. B. YUDELSON: How much time do you give for each display?

STATE PSYCHOPATHIC HOSPITAL

DR. LEVY: As much time as they want. It is not a time reaction test at all. The whole difficulty in the test is the ability to classify the different types of responses. When one has them classified the diagnosis is easy. As already explained, "formal" in interpretation, i. e., by checking replies against tables, in much simpler than "individual" in interpretation.

BOSTON SOCIETY OF PSYCHIATRY AND NEUROLOGY

Regular Meeting, Thursday, Nov. 18, 1926

DONALD GREGG, M.D., *President, in the Chair*

MUCINOID DEGENERATION OF THE OLIGODENDROGLIA. DR. PERCIVAL BAILEY and DR. GEORG SCHALTENBRAND.

During the routine pathologic examination of the brain in a case of Schilder's encephalitis periaxialis diffusa, we have been able to prove that the acute swelling of the oligodendroglia as described by Penfield and the mucinoid degeneration of Grynfeltt are identical. The article will be published in extenso later.

DISCUSSION

DR. E. W. TAYLOR: Does mucinoid degeneration occur in any other form of cell?

DR. BAILEY: No. We have examined our material carefully and have not seen it in any other cell. It is a process that affects only the oligodendroglia.

DR. DONALD GREGG: What is the disease condition?

DR. BAILEY: Encephalitis periaxialis diffusa of Schilder. Dr. Grynfeltt has examined many normal brains for this type of lesion and has not found it. The work of Grynfeltt has not been generally accepted. Different people have tried to repeat it and have rather cast doubts on the validity of his conclusions. When we examined this brain we did not find anything. We found that in order to obtain good staining we were obliged to refix the tissue in corrosive sublimate. That probably explains the failure of others to get results.

DR. D. J. MACPHERSON: Dr. Myrtelle Canavan of the Psychopathic Hospital found a similar type of degeneration in the midbrain of a person dying of epidemic encephalitis. She was interested in the lesion and asked for a diagnosis from several different laboratories, but she found no one at that time who would express a definite opinion as to the nature of the degeneration.

DR. BAILEY: It is interesting to me because it is exactly where one would expect to find the degeneration, since the oligodendroglia lies mainly in the white matter of the brain.

THERAPY IN PARALYSIS AGITANS. DR. MAXWELL E. MACDONALD.

A series of cases showing Parkinson's syndrome has been selected for a comparative study with various methods of therapy. The methods investigated were: (*a*) Drug therapy: (1) parathormone; (2) bulbocapnine; (3) sodium salicylate; (4) scopolamine hydrobromide. (*b*) Physiotherapy: (1) passive — massage and heat; (2) active — conscious reeducation.

A careful physical and neurologic examination was first made. The laboratory work included a blood Wassermann test, blood calcium estimation, and blood carbon dioxide tension (in a few cases).

In some cases an examination of the spinal fluid was made, which included pressure readings, cell count, globulin, Wassermann and colloidal gold test, total protein and calcium estimation. In a few cases electromyograms were made.

Results.—The neurologic examination seemed to divide the cases clinically into: (1) those with a history of encephalitis, showing as the predominating sign rigidity with relatively little tremor, and (2) the so-called idiopathic group, which showed tremor to a much greater extent. Most of the cases showed pyramidal as well as extrapyramidal signs. Two cases not showing clinical evidence of tremor did show on electromyographic studies a beginning of a periodic excitation. Within the time of the series, one of these patients developed a tremor that could be noticed.

Parathormone (Collip's parathyroid extract).—Reports have been made of symptomatic improvement following the use of parathyroid extract. It was decided to use Collip's preparation because of its definite action in increasing the blood calcium. The blood calcium figures in untreated patients fell well within normal limits. Parathormone was given subcutaneously in from 10 to 20 unit doses, with an average increase of blood calcium of 33.3 per cent. In one case an increase of 75 per cent resulted. An attempt was made to vary the hydrogen ion concentration by giving ammonium chloride. In these cases a daily blood carbon dioxide estimation was made. The blood calcium curve followed in an increased ratio to the carbon dioxide curve. In other words the calcium figure was highest at the height of the acidosis. There was not any obvious clinical improvement in any of the cases in which parathyroid was used.

Bulbocapnine.—The use of this alkaloid in various tremors was described by de Jong and Schaltenbrand in 1924. I used it in doses of from 0.1 to 0.2 Gm. subcutaneously. Experience would lead me to state that it is not effective in paralysis agitans following epidemic encephalitis and only in a part of the cases of the other group. In a few cases of severe tremor it worked well, stopping the tremor in a few minutes for several hours. The field for its use seems to be sharply drawn.

Sodium Salicylate.—The intravenous use of sodium salicylate followed from the optimistic reports of the Paris clinics. Not enough was done with this to draw any definite conclusions, but certainly in a few cases of the chronic encephalitic type there was a distinct relief of symptoms. There was diminution of the tremor, which was noticeable, and subjective relief of the rigidity. Fifty cubic centimeters of a 4 per cent solution was used three times a week. This method is worth further trial.

Physiotherapy.—It was found that while passive methods of physiotherapy gave some immediate relief there were no lasting results. It was concluded that it was not worth a great expenditure of time. On the other hand, I feel that a conscientious attempt on the part of the patient to do a series of graded exercises for the correction of posture leads to distinctly beneficial results. This seems surprising in view of the extreme rigidity in some cases, but it is a valuable adjunct to any treatment.

Scopolamine Hydrobromide.—This still remains the most satisfactory drug for routine use. Given in from 1/200 to 1/100 grain doses, one to several times daily, most of the patients were relieved to some extent.

Conclusions.—It seems that as clinical and pathologic evidence points to a progressive disease in the paralysis agitans following encephalitis, one should call this chronic encephalitis instead of postencephalitis. Efforts toward effective therapy should be directed to the discovery of the cause of the infection and to the development of specific therapy. As about 90 per cent of the cases in the clinic at this time are of this type, it obviously stands out as the more important group for therapy. In addition to this numerical preponderance is the fact that many of the cases occur in young people.

DISCUSSION

DR. E. W. TAYLOR: I was particularly interested in what Dr. Macdonald said about the use of scopolamine and in the action of its closely related drug which he did not mention. I use scopolamine exclusively, and my results have been different from those Dr. Macdonald mentions. He says that so far as hyoscine has been useful at all, it has been helpful in stopping tremor. I have found it extremely useful in controlling rigidity and not so useful in cases of tremor. I recall one case of parkinsonian syndrome following encephalitis of the most severe type. The patient was completely helpless, drooling, unable to feed himself, slovenly and not able to get about; apparently, he was in a low state. I gave him a large dose, 1/100 grain, three times a day, and in about a week or ten days he came in alone to see me at my office, well dressed and entirely capable of getting about and taking care of himself in every respect. The improvement, however, was by no means complete, and he has remained in a state of partial disability. The primary improvement was little short of miraculous. I have used scopolamine regularly, and I almost invariably meet with favorable results. I have seen practically no effect on the tremor.

DR. TRACY J. PUTNAM: I have no first-hand knowledge of bulbocapnine, but Dr. Schaltenbrand asked me to show some of his lantern slides. I saw some of the patients with whom he was working in Amsterdam. There they studied only cases of idiopathic senile paralysis agitans and did not have the opportunity to try the drug in postencephalitic cases. Not all patients responded favorably to the drug. Some were unaffected by it. In some of these scopolamine seemed to have some effect, and in other cases bulbocapnine had an effect in decreasing the tremor when other drugs were useless. In a recent paper by Loewy, Dr. Schaltenbrand told me that he reports a number of cases, some of the idiopathic senile paralysis agitans and some of the encephalitic form, and found that there was probably never any effect in the postencephalitic cases with bulbocapnine. Other papers have appeared reporting a much larger number of senile paralysis agitans, and about one third of his patients were unaffected by the drug. It was the impression of Dr. Schaltenbrand and Dr. de Jong that the tremor was favorably influenced by bulbocapnine, but that this had no effect on the rigidity; and while it is perfectly true that it would be preferable to have a truer agent to combat paralysis agitans, in the lack of that one turns to symptomatic measures, and in some cases (probably not a large proportion) in which the tremor annoys the patient more than the rigidity, or in which the tremor is annoying in addition to the rigidity, bulbocapnine may find a place. There is no doubt that its use still remains to be defined.

CLINICAL CONSIDERATION OF SPECIAL TYPES OF FEEBLEMINDEDNESS. DR. ABRAHAM MYERSON.

This is a summary of a study carried on at the Wrentham State School under my direction and that of Dr. H. B. Elkind. It was undertaken to see whether or not figures at the Wrentham State Hospital would corroborate or disprove a different type of study carried on at the Walter E. Fernald State School at Waverley. In the earlier study (the one carried on at the Walter E. Fernald School, which has already been reported before this society), the statistical analysis was secondary to an intensive individual and clinical study.

1. There were 1,044 cases at the Wrentham Hospital in which the histories were studied. Most of the information, however, concerns smaller numbers. The following appears to be the case concerning the 1,044 inmates: 95 per cent were white and 5 per cent colored; 42 per cent males and 58 per cent females.

2. It is evident on a close study of admissions and the causes of admissions that there are more females in Wrentham largely because feebleminded females seem to get into more social difficulty, or are regarded with more social concern, than are the males. This is evidenced by the fact that the admission age of the females is much higher than the males, and is nearer the age of puberty.

3. In general, the social level of the families of the group is much lower than that of the general population; many more are from dependent families and institutions.

4. There are more morons among the females, and the males have more idiots and low imbeciles. The study of the reasons for coming to the institution explains this. Idiots and low imbeciles come in largely because they are more difficult to care for; morons come in because of immorality either in their personal lives or in their background, and for delinquency. Thus it is evident that a social rather than a biologic selection takes place. In Massachusetts there are far more agencies concerned with girls than with boys, and this also helps to account for the larger number of females of the moron type and of the adolescent age.

5. The size of the families bears on the mooted problem of the prolificity of the feebleminded. The average family, at Waverley, from which the inmates come is 3.8; the average Wrentham family is 4.5. The Wrentham family is only slightly larger than that of the general population of Massachusetts, but not larger than the cultural level of the group from which the inmates come leads one to expect. It is well known that the higher the cultural level, the lower the birth rate. Independent of the mental status of the families from which these patients come, their lower cultural status explains the slightly increased birth rate. At any rate, no matter how regarded, there is no evidence either in this study or in the study of the late Dr. Walter E. Fernald on the discharged patients from the Waverley institution, to show that the families from which the feebleminded come have a high birth rate.

6. Studies of siblings of the feebleminded showed that: (*a*) The statistical analysis of the number of feebleminded siblings in relation to the size of the family has not been completed, and the figures are too small to be of great value. Among the known cases of the males, the patient was the only member of the family that was feebleminded in two thirds of the cases. The figures for females differ only slightly from those of the males. A cursory survey of the figures does not indicate that feeblemindedness runs nearly so strongly

in families as has been alleged. This corroborates the Waverley studies. (*b*) In the relationship of feeblemindedness to mental diseases; the number of siblings of the patient who have mental diseases is negligible. This, of course, is easily explained on the ground of the age of the siblings who are, in a general way, too young to have recognizable mental disease. (*c*) There are few siblings of the feebleminded patients who have epilepsy; this is not greater than one would expect in view of the prevalence of epilepsy in the community. It is the experience of every general hospital that epilepsy is common, probably more common than feeblemindedness or the mental diseases.

7. The descendants of the feebleminded persons in Wrentham are too few and, in a general way, too young to show much of importance. There are fifty-seven cases in which it is known that there are children. Twenty cases have been followed up, and in only two of these was there feeblemindedness. Walter E. Fernald's figures are of interest in relationship to this—646 patients were discharged from the Waverley institution during his incumbency as superintendent; twenty-seven of these people married; there were fifty children, and thirty-three of the children survived. (This does not indicate a high prolificity of the feebleminded.) His examination of the children of these feebleminded mothers showed them to be nonfeebleminded in every instance.

8. Study of the parents of the feebleminded showed: (*a*) At Wrentham, where the study was associated with great difficulty, the conclusions have not yet been analyzed, but they indicate the following conditions: Both parents were apparently normal in 69 per cent of the male patients; both parents were normal in 54 per cent of the female patients. In 10 per cent of both groups, one parent was feebleminded, and in 6 per cent both parents were feebleminded, showing that the feeblemindedness of the parents is a significant factor. There was not enough epilepsy in the parents to be of significance. (*b*) In regard to mental diseases, there were three cases in which both parents had mental disease, as contrasted with forty-nine in which both parents were feebleminded; there were thirty-five cases in which one parent had mental disease as contrasted with seventy cases in which both parents were feebleminded. The study of these thirty-five cases with mental disease shows a good many conditions which are not regarded, on the basis of a published study of the inheritance of mental diseases (Myerson: Inheritance of Mental Diseases), as significant; in other words, they are exogenous rather than endogenous. There were four alcoholic psychoses, five cases of general paralysis, and two cases of toxic psychoses after pregnancy.

It is significant that of these thirty-five patients with mental disease, there were often some who were diagnosed in institutions as feebleminded and not insane; seven cases finally simmered down to endogenous mental disease; there were four cases of dementia praecox, two cases of manic-depressive psychoses, and one case of cardiorenal vascular disease. In a study of these cases, it is not felt that, in the main, mental diseases of the parent can be stated to be of relevance in the history of a person with feeblemindedness.

9. The study of the relationship of syphilis to feeblemindedness shows that 3.5 per cent of the patients had positive Wassermann reactions. The Solomons, in their study of "Syphilis of the Innocent," showed that reports concerning the incidence of syphilis in the young are contradictory, but they conclude that about 5 per cent would show a positive Wassermann reaction. Thus the reaction of the population at Wrentham is certainly not more than that of the community. It is significant that 35 per cent of these were females, morons

with a history of irregular sexual life. In other words, the chances are strong that, at least among the females, there was acquired instead of congenital syphilis.

In the Waverley study, the reasons for concluding that syphilis did not play a rôle in feeblemindedness were stated; the Wrentham studies seem to corroborate this. If it plays a rôle, it is that of a minor, unnamed supernumerary instead of that of star performer. The importance of syphilis in the pathologic changes of feeblemindedness has been distorted by the traditional issues which intrude themselves into science with every reference to sex and morals.

10. The concepts of relative feeblemindedness and technical feeblemindedness are introduced to account for a good deal of the sporadic feeblemindedness and much of the familial feeblemindedness. In every human quality there is fluctuation up and down, and intelligence is no exception. In a high grade family, fluctuation downward is not as apt to produce a moron as an individual lower than his group, that is, a relatively feebleminded person. In the case of a low grade group, above the technical feebleminded level, a fluctuation downward is apt to produce a technically feebleminded person. The term "technically feebleminded person" is used to indicate that the concept of feeblemindedness is not an absolute one, and cannot be scientifically defined or justified.

DISCUSSION

DR. G. L. WALLACE: We are much indebted to Dr. Myerson and his co-workers for the notable work they are doing. When the pathologic groups, the cretins, mongolians, spastics and a few special groups are separated from the mass, feeblemindedness, as Dr. Myerson outlines it, is then viewed as a condition and not as a mental disease. It is a pathologic condition, but is social, not medical. I am sure in saying that to a medical audience I am not going to be misunderstood for, primarily, from its origin one must consider it as a medical problem, but the problem, as the community meets it, is a pathologic social condition. This condition, which is easily classified today within the realm of feeblemindedness, ten or twenty years ago was not within that realm. A few years ago, before the social order of things became so complex and exacting, many of these people with low mentality and disturbed emotional natures were able to make better adjustments with their environment than they are today. And then, when they were out of alinement with their environment, they were not classified as feebleminded but received consideration by the courts and various social organizations and were treated in accordance with the symptoms they presented.

Dr. Myerson has clarified the problem to a great degree by separating it from mental diseases and from the pathologic groups of feeblemindedness. By so doing he places this problem where it may be viewed as one stratum of society. Even so, it is none the less a serious and significant problem. I agree with Dr. Myerson that it is not a problem of intelligence that is being dealt with in abnormal behavior in the higher moron age levels. In our survey, a few years ago, of 100 girls with a mental age of 11 and 11 plus, we found on investigation of the family histories that the member of the family that we were dealing with in each instance was simply a cross section of the family. The reactions in our cases were similar to those of brothers, sisters, fathers, mothers, uncles, aunts and grandfathers and grandmothers of the patients. We found that the reactions of these families, for generations,

were out of alinement with the social requirements of the communities in which they lived. It seems that there are potent, positive and powerful biologic factors dominating this great problem of the unclassified feebleminded. Since Dr. Myerson has so successfully segregated this large group of unclassified feebleminded, we are now anxiously awaiting the next step which I hope, will be the breaking up of this group into well-defined sections.

Dr. Myerson: It is astonishing how many children are born with blood in the spinal fluid. The work of Sharpe and of others in Germany shows that children who are apparently born normally have had either a subarachnoid or an intraventricular hemorrhage or, at least, blood has found its way into these situations. Blood in the spinal fluid does not, of course, adequately represent damage in the cortical or subcortical areas. An interesting series of articles has appeared on the effect of encephalitis on the mentality of children, showing that mental defect follows in at least a small proportion of cases. A personal follow-up of children who had encephalitis and who had been treated at the Boston Children's Hospital showed that mental deficiency was to be expected in some instances. The number of cases was too small to permit one to be dogmatic about the condition.

In regard to Dr. Wallace's remarks, most of the girls with a mental age of 11 do not get into trouble, but those who do are sent to his institution or other schools for the feebleminded. There are girls of the same temperament, but with a higher mental age, in the reform schools. Heredity should be invoked as explaining things only when it can be proved — not as a working hypothesis. As a working hypothesis, it kills research into more easily handled causes. Ignorance of causes has usually paraded as heredity — witness the history of tuberculosis, goiter and epilepsy.

PHILADELPHIA NEUROLOGICAL SOCIETY

Regular Meeting, Nov. 26, 1926

W. G. Spiller, M.D., *President, in the Chair*

Interesting Neurological Symptoms and Findings in Pellagra. Dr. N. W. Winkelman and Dr. J. B. Klauder.

The three patients presented are alcohol addicts, in whom symptoms of pellagra appeared after an acute alcoholic debauch. They are shown because of paresthesia involving the legs, of which they all complained grievously and which has persisted to the present. The blood Wassermann and spinal fluid examinations gave negative results in all three.

Case 1.—A man, suffering with acute alcoholism at the time of admission to the hospital, six months previously presented the typical eruption of pellagra — a "gloved" dermatitis, lesions of the mouth and the tongue and diarrhea. For a brief period after admission he was disoriented; this was the only mental symptom. The diarrhea persisted for about three months. The only complaint now is paresthesia; the cutaneous lesions and those in the mouth have disappeared. The pupils are irregular and react sluggishly to light. The patellar reflexes are exaggerated. The muscles of the calf are not wasted nor is there any tenderness on deep pressure.

CASE 2.—A man, on admission to the hospital six months before presentation, had the cutaneous lesions of pellagra. His skin is now normal. The only complaint is paresthesia. The pupils are irregular and react sluggishly to light. The patellar reflexes are exaggerated. The muscles of the calf are not wasted nor is there any deep tenderness.

CASE 3.—A man presented the cutaneous picture of pellagra on admission to the hospital about six months before presentation. On a previous admission to the hospital, a diagnosis of alcoholic neuritis was made, and at another time one of posterolateral sclerosis. He now complains of paresthesias of the legs. The gait is definitely spastic and ataxic. The pupils are slightly irregular; the left is larger than the right, and both react sluggishly. There is a slight lateral nystagmus to either side, with fine tremors of the tongue. The upper limbs are not ataxic, but they show decrease in strength without local atrophies. The reflexes are all active, especially on the left side. There are no tremors of the outstretched fingers. There is a typical Hoffmann sign on both sides. The lower limbs show slight general weakness, especially on the left. The knee reflexes are both active, especially the left, and the ankle reflexes are decreased on both sides. Clonus is absent. A Babinski sign is present on both sides, but without a Pusseps reflex. There is decreased sensation from just below the nipple, which is definite. There is slight decrease of vibration sense, especially in both feet. Muscle position is lost in the right foot and is much more acute in the left foot; there is slight loss in the upper limbs, especially the right. Sensibility to pin prick is decreased on both sides, more on the right, with probably a level just below the nipple. The cremasteric and abdominal reflexes are absent.

DISCUSSION

DR. F. X. DERCUM: What was the condition of the mucous membranes at the time the man was first observed? It is common to have these membranes involved. I understand that one of the patients had a hallucinatory delirium. Did the delirium resemble that of delirium tremens? Was there a predominance of visual hallucinations?

DR. J. B. KLAUDER: This patient presented only the cutaneous picture and diarrhea. The second man presented only a mild confusion with disorientation.

THE SEROLOGY OF GENERAL PARALYSIS IN MALARIA TREATED CASES. DR. A. FERRARO.

Investigation in ninety-five cases of general paralysis revealed: 1. Treatment by malaria exerts a surprisingly beneficial influence on the serology. 2. The serologic improvement gradually increased from 15 per cent of the cases within six months from the date of inoculation with malaria to 85 per cent of the cases within thirty-six months. 3. The first element which improved after malaria treatment was the pleocytosis, which was reduced within a few days. Of the cases of more than twenty-four months' standing, 7 per cent showed great improvement, while 50 per cent showed a complete reversal to the normal number of cells. 4. The globulin content, although it improved gradually, showed a less pronounced reduction than the cell content. 5. The Wassermann reaction with the cerebrospinal fluid was third in order of improvement. The rate of improvement, which within the first six months was 20 per cent, increased to 90 per cent within thirty-six months. Sixty-eight per cent of all cases of thirty-six months' standing showed a completely negative reaction.

6. The colloidal gold reaction was the most resistive element to the treatment; within twelve months, only twelve of thirty-nine cases showed signs of improvement. The improvement then gradually increased, although reversal to an absolutely normal curve was rare. 7. The blood Wassermann reaction rapidly improved, and within the first six months 28 per cent of the cases showed a negative reaction. After thirty-six months the percentage reached 86. 8. Occasionally, in the earlier stages following malaria treatment, some of the serologic reactions are apt to become temporarily worse. It has been noticed that in a few cases, although the clinical improvement is unmodified, the serology, especially the colloidal gold reaction, is likely to become slightly worse. 9. No parallelism was found between the serologic improvement and the maximum temperature of the paroxysms, while parallelism was evident between the number of chills and the percentage of cases in which improvement occurred. 10. In the earlier periods following malaria treatment there was no parallelism between the clinical and the serologic improvement. The parallelism was found later, as within thirty-six months from the date of treatment all cases in which there was clinical improvement showed serologic improvement. Conversely, not all cases in which there was serologic improvement showed clinical improvement.

DISCUSSION

DR. C. A. PATTEN: It may be that I did not understand, but I received the impression that these patients have all received treatment for syphilis other than malarial; if this is so, it seems to me that it negatives the value of the reports from the standpoint of the efficacy of malarial treatment. It is well known that other remedies — the arsenicals, bismuth and mercury — will produce similar improvement clinically and serologically. From the standpoint of pure science, the patients should be given only malaria treatment and the results compared with reported statistics on chemotherapy or chemotherapy plus malaria.

THE TREATMENT OF NEUROSYPHILIS BY INOCULATION WITH MALARIA. DR. GEORGE WILSON.

This article will be published in full elsewhere.

HISTOPATHOLOGY OF PARESIS TREATED BY MALARIA. DR. WALTER FREEMAN.

This article will be published in full elsewhere.

ACUTE ENCEPHALITIC PARKINSONISM. DR. BERNARD J. ALPERS and DR. CLARENCE A. PATTEN.

This article will be published in full elsewhere.

Book Reviews

EPILEPSIE — VERGLEICHENDE PATHOGENESE, ERSCHEINUNGEN, BEHANDLUNG. L. J. J. MUSKENS. Pp. 386. Price, RM 30. Berlin: Julius Springer, 1926.

This work is an ambitious monograph, no. 47, of a series edited by Foerster and Wilmans. The first part has to do with experimental myoclonic epilepsy. An excellent historical review is given of such experimental methods as anemia, stimulation of the cortex, injury of the cord, and poisons. The author sets out to discover: (1) whether there is any experimental method that can give phenomena really analogous to epilepsy; (2) given such a method, what form and latency the graphically recorded convulsive movement may have, and (3) in what way lesions of the central nervous system may change the effects of a general convulsant drug. From the literature he concludes that no drug satisfies the criteria; therefore, it cannot be said that any drug produces epilepsy. Absinthe and camphor come nearest to fulfilling the desiderata, especially the latter, which causes animals to have repeated attacks closely resembling the myoclonic form of epilepsy.

Study of myoclonic epilepsy, therefore, is the author's starting point and a large series of experiments is described. These include observations on the myoclonic reflexes of various animals and on the effect of monobromcamphor on cats. This drug not only causes motor attacks but also shows "compensation," i. e., the freedom from attacks following a severe seizure because of the "elimination of a toxic state by means of the attack." This conception seems to interest the author greatly, though it is not clear how he can speak logically of this form of compensation as having anything to do with the compensation that he describes in man when periodic headaches are replaced by myoclonic spasms, and these in turn later are replaced by epileptic attacks.

The experiments show that bromocamphor tends to lower the threshold for electrically stimulated cortical convulsions and to make them less focal; even mechanical stimuli of the cortex may then cause convulsions. Furthermore, electrical stimulation of the medulla can bring on attacks. The latter were ipsilateral and were more easily elicited than those from the cortex; just after an attack the excitability was much lower than just before. These observations caused the author to think of a medullopontile center for myoclonic reflexes and fits, but the fact that these reflexes in a rudimentary form can be elicited from the isolated cord argues for a widespread origin. Moreover, the contralateral cortex with its pyramidal tract and the ipsilateral cerebellum have a distinct effect on the reflexes. Operative decompression of the posterior fossa makes it more difficult to elicit convulsions, i. e., more of the drug has to be used.

Tactile and acoustic stimuli are best suited to elicit myoclonic phenomena; the proximity of the medial and lateral lemnisci as they pass upward, the connections of the posterior corpora quadrigemina, and the tractus tectoreticularis are mentioned as anatomic considerations of importance in explaining this. The fact that a deafferented leg (dorsal root section) does not take part in a general myoclonic fit certainly is of interest.

A great number of experiments are described in detail and the author must be congratulated on his perseverance in following up this minute analysis of

the myoclonic reflex. He believes that myoclonic attacks are to be looked on as a kind of reflex "after-discharge"; this applies both to the experimental animals and to man—when all stages of development from simple tactile and acoustic reflex contractions to marked epileptiform attacks are observed. He finds that the complete attacks of myoclonic epilsepsy develop only when the pyramidal tracts are intact. In conclusion, the author emphasizes his belief that myoclonic epilepsy is not a rare, special form of the disease, but is rather the prototype of genuine epilepsy.

In going over the experimental work more in detail, one feels that certain criticisms are justified. In the first place, what is there about these "myoclonic reflexes" that makes them so specific an entity? Wherein do they differ from ordinary spinal reflexes, especially from those seen when the threshold is lowered with drugs? Certainly the latent and refractory periods, so carefully studied, indicate no great specificity. These reflexes, often studied in intact cats, are so complex that the simple mechanical records of the movements of limbs or muscles give little idea of the mechanism. No mention is made of Sherrington's recent work on myotatic reflexes (in fact the most recent reference to Sherrington is in 1912). The refractory phase is discussed in the light of the "all-or-nothing" law as it was understood by Vecsy in 1910, with no mention of the newer and revolutionary work on this subject by Lucas, Forbes, Kato, Pratt and others. Likewise, the periodicity of the repeated contractions is considered, and Piper's electromyographic observations (1907) are quoted, no mention being made of the new interpretations of Forbes, Adrian and others. In fact the physiologic methods and interpretations are not up to date. This part of the monograph is valuable as a special study, but seems poorly coordinated with the rest of the book which has to do with epilepsy and its treatment.

The third part of the book is a treatise on human epilepsy and its treatment. From his physiologic work, the author has gained the standpoint that "the epileptic attack is nothing but a reflex after-effect, presumably a reserve defense-reaction of the organism against certain poisons." With this thesis always in mind he gives his readers the benefit of a rich clinical experience and a broad knowledge of the history of epilepsy. The result is a good reference book, but for reading it is at times too redundant to be interesting.

Epilepsy is classified in three different ways but, since the etiology is unknown, none is satisfactory. Perhaps the most useful is that referring to the clinical mode of onset: (1) partial or jacksonian; (2) primary grand mal; (3) primary petit mal; (4) primary myoclonic. Under "myoclonic," however, Muskens includes more than is usually thus classified, for most clinicians think of Unverrichts' progressive form as the type. However, this broadness of conception is presumably due to his viewing all epilepsy from the starting point of myoclonia. "Compensation," as discussed in his experimental work, also comes in for an undue share of notice. He cites many cases in which all symptoms disappear for a period after a hard attack, and describes how much better the patients feel. (Much clinical experience, however, does not agree with this.)

The convulsions of childhood are discussed in a useful manner, being divided into: (1) the normal twitchings of infants; (2) tonic spasms of infants; (3) encephalitic convulsions; (4) symptomatic convulsions (Gelegenheitskrämpfe); (5) spasmophilia; (6) tetany; (7) tantrum spasms. The author mentions the possibility that incomplete myelinization may play a rôle, and emphasizes the frequency of encephalitis as an etiologic factor. Spasmophilia

and the symptomatic convulsions occurring with fever are considered as related to myoclonic reflexes. (It would seem simpler to describe the process as a lowering of neuromuscular threshold.) In considering the bearing of the convulsions of childhood on later epilepsy he gives figures which show that 8.7 per cent of epileptic persons have had symptomatic convulsions in childhood, 13 per cent encephalitis in childhood, and only 1.2 per cent spasmophilia. In closing this chapter he rightly urges all practitioners, when examining a child in convulsions, to take the temperature, look for focal neurologic signs, and distinguish respiratory spasms from fits. As a differential point between epilepsy and symptomatic convulsions, he says that in the former the spells usually come singly with free periods following, whereas in the latter they usually come in series with twitchings before and after.

The description of other forms of epilepsy also is well arranged and full of interesting clinical observations. The discussion of the clinical pathology, however, is inadequate, no mention being made of the recent work on blood chemistry, metabolism and acid-base equilibrium. In his zeal to explain everything on a toxic basis he thinks that the postconvulsive increase in lactic acid may explain the psychic disturbances — not considering the common cases of "equivalents," in which there are no muscular spasms but marked mental symptoms.

Under the heading of "statistics and etiology," various interesting data are given. The figures of occurrence indicate that about one person in three or four hundred has epilepsy. The figure for "inherited tendency" is higher than that given by most recent authors, Muskens' figures showing more than 20 per cent of the cases as the result of direct inheritance. All statistics are critically discussed. Under etiology, the ordinary possibilities such as trauma and syphilis are considered. Of special interest is the stress on anoxemia as a possible cause. The author cites cases of partial suffocation with resulting convulsions and speculates as to the relationship of this to the well known tendency of epileptic persons to have seizures at the moment of falling asleep or awakening. (Earlier in the experimental part of the book, the myoclonic aspects of these movements in man and animals have been mentioned.) Little is known, however, of the functions of the blood during sleep, and hyperventilation is known to lead to tetanic spasms. Other cases are mentioned in which starvation, the overeating of fat, and the overeating of protein are held to be etiologic factors. (No mention is made of the beneficial effects of the first two on certain cases of epilepsy.) Muskens is in favor of the theory of protein intoxication, but admits the complexity and difficulty of weighing the evidence. In general, however, this chapter leaves one with a bewildered feeling — so many clinical cases are cited in which fits are supposed to have been caused by one factor or another. "Insulin convulsions" are discussed, and an unconvincing analogy is drawn with epileptic spells.

Under treatment, Muskens wisely insists on the individuality of each patient and the need of a careful history. For purposes of therapy cases are divided into: (1) suspects; (2) patients who have had occasional undoubted fits; (3) those with regular attacks; (4) chronic cases with the attacks crystallized into a definite type and (5) institutional cases in which deterioration had taken place. Treatment with drugs is described, but nothing new is brought out. Prophylaxis and social hygiene are discussed interestingly; a plan for the training of the parents of epileptic children is outlined, in which they are to be shown the importance of avoiding overstimulation and of providing natural sleep and much rest for the patients.

Only six pages are given to pathologic anatomy, but in this brief space the principal facts are mentioned, and many references are given. The author's attitude is that the anatomic changes described in many cases may well be explained as results of repeated convulsions, chronic illness, and years of medication. In order to obtain a real idea of the pathologic anatomy, one needs more necropsy material from early and arrested cases in which the patients have not become chronic invalids.

In the last chapters traumatic epilepsy, tumors of the brain and surgical treatment are discussed.

La Syphilis Nerveuse. By A. Sézary. Price, 80 cents. Pp. 208. Paris: Masson et Cie, 1926.

This book may be considered an exposition of the work done by the author over a period of approximately twenty years on the subject of syphilis and its relation to the central nervous system. The richness of the material is evidence of the industry, originality, and wide interest of the author. It is, of course, put together as a running text, and the only indications that it is to be taken as a summary of the author's work are the references to his original articles and also the fact that his personality and experience dominate the exposition. This is obviously the work of a syphilologist and biologist rather than a neurologist. Syndromes and symptom complexes, clinical classifications, discussion of localization of function and reflex disorders are all conspicuous by their total absence. On the contrary, the subject is handled from the standpoint of a syphilitic infection as it affects the human nervous system.

The book begins with a discussion of the involvement of the nervous system in the early secondary period of syphilis. It goes on with a discussion of the etiology of the parenchymatous types of neurosyphilis with the pathogeneses of general paralysis, tabes, arterial disease and meningitis, ending with a brief account of the author's ideas concerning treatment.

When a man writes of the work in which he has been a pioneer contributor for more than a score of years, one cannot fail to find great stimulation as well as interest and edification in his book, especially when it is written as concisely and with as much precision as this one. There are many points with which the reviewer is not in entire accord with the author.

The book begins with a statement that there are two epochs in the study of syphilitic meningitis; first, the one in which neurologists showed the constancy of meningitis in certain nervous affections such as tabes and general paralysis, and second, the one that began with the work of Ravaut, in 1902, who discovered the latent meningitis of the secondary period of syphilis. The meaning of this type of latent meningitis, which occurs not only in the secondary but also in the tertiary period, greatly interested the author, who finds that one cannot draw conclusions easily from these observations. The histologic lesions, he says, are only remarkable by being discrete as compared with other meningitides. The leukocytosis is by no means pathognomonic, revealing itself solely as a subacute or chronic reaction. *Treponema* has been found so infrequently in these latent cases that it may be considered as probably nonexistent, and Sézary says that the organisms never have been found in the meninges of a tabetic person. Neither have the organisms been found in the diffuse cellular infiltration of the pia mater in general paralysis. He concludes that recent studies indicate that general paralysis is a cortical

encephalitis and that the meningitis which accompanies it is merely a contingent process. As to tabes, he is unwilling to make the same statement in regard to the meningitis but says that the situation is still unclear, except for the absence of organisms in the membranes. A brief discussion of the French point of view of the origin of the tabetic lesion is given, but one misses any references to the German literature, especially the work of Richter. In summing up the matter of latent meningitis, the author makes the following interesting statement: In admitting that the latent meningitis occurring in a syphilitic person is of syphilitic nature, that is, is determined directly by *Treponema*, one uses simple logic; one states an apparently reasonable fact, but one that has not been demonstrated scientifically. The meningitis revealed by lumbar puncture in a syphilitic person appears to the author as evidence of and not the cause of parenchymatous nerve lesions.

The second chapter contains a long discourse on the question of the neurotropic virus, which, Sézary believes, has not been proved to exist. His review and critique of this matter is complete and could serve well as a summary of the present knowledge on this subject.

As a result of his studies of the changes in the spinal fluid occurring spontaneously in cases of general paralysis, he concludes that the slight changes found while following a case for a considerable period are of relatively minor importance but are sufficient to make one guarded in attributing all such changes in treated patients to the effect of the medicaments employed. However, if an attenuation of the biologic anomalies of the fluid is durable, it will allow one to conclude that the medication has been efficacious in affecting the general paralytic process.

Sézary lays great stress on the importance of early diagnosis of involvement of the central nervous system; that is, early in the course of the syphilis. This evidence can be obtained in the majority of cases only by an early examination of the cerebrospinal fluid and, as he well says, the future of the syphilitic patient is fixed during the secondary period of the disease. It is refreshing to find a syphilologist emphasizing this point of view. The reviewer fears that this is more frequently appreciated by the neurologist than by the syphilologist who treats the early forms of the disease.

It follows, then, that lumbar puncture should be performed in the early course of syphilis. The author discusses at length just when this should be done, that is, whether the puncture should be done at the beginning of treatment, after a certain period of treatment, or whether it should be delayed until later in the course of the disease. He comes to no definite conclusion except that it should not be done too early, while the septicemic condition exists, nor should one wait too long. Too much emphasis cannot be laid on the importance of the point of relatively early investigation of the cerebrospinal fluid in all cases of syphilis. The author's account would be much more valuable if he had discussed some of the fundamental work by American investigators, such as that done by Moore and Keidel at the Johns Hopkins clinic.

The absence of the international point of view, but rather the presence of a French one, is brought out clearly in the discussion of the treatment of neurosyphilis. A glance through this discussion, however, will convince the average American neurologist and syphilologist how little is generally known in America concerning the various French preparations. The author is enthusiastic about the value of treatment in the meningovascular types of neurosyphilis. His statement that in syphilitic hemiplegias, if energetic treatment is started in the first hours of its appearance the hemiplegia is susceptible

of complete cure, is unique. This is based on the idea that the hemiplegia is the result of the activity of the spirochete in the vessel wall, which activity can be halted completely by treatment.

Discussion of the treatment of tabes is extremely meager, taking up less than five pages. The general conclusion is that tabes is quite amenable to arrest by treatment, and Sézary is apparently satisfied to depend on relatively small doses of arsphenamine and mercury. He has nothing to say about intraspinal therapy, which apparently, he does not consider as of any value though he does not discuss it.

In the treatment of general paralysis, the author is fairly enthusiastic about the effect of stovarsol, a pentavalent arsenical somewhat similar in composition to tryparsamide. He stresses this drug as superior to tryparsamide but gives insufficient facts on which to base such a conclusion. It is, however, interesting to note that he has found a pentavalent arsenical, the effect of which on general paralysis is superior to that obtained by any other drug therapy. His conclusion as to the value of this drug is based on the treatment of forty-four cases. These cases, he says, were all institutional and of an advanced type. He reports that the results were good in 27 per cent, passably in 9 per cent, and mediocre in 11 per cent, whereas the remainder did not show any improvement. The febrile methods of treatment are not discussed. Obviously, the part of the book dealing with treatment is the weakest, but it does bring out an interest in the drug stovarsol.

CAVERNOUS SINUS THROMBOPHLEBITIS. By WELLS P. EAGLETON. Pp. 196. Price, $4.50. New York: The Macmillan Company, 1926.

This volume embraces a consideration not only of cavernous sinus thrombophlebitis but also of allied septic and traumatic lesions of the basal venous sinuses. The value of the study, which is based on twenty-five personally observed cases of cavernous sinus thrombophlebitis, with twenty-one deaths and four recoveries, is enhanced by a detailed report of autopsies in twelve cases.

According to the author, the object of the study is to emphasize the importance of the following considerations: for an early diagnosis, cavernous sinus thrombophlebitis must be regarded as a group disease; the classic picture may or may not be present, and in cases of slow involvement without the classic symptoms (the most promising type for surgical intervention) the following factors must be considered: the path of entrance of the infection into the sinus, the part of the sinus attacked, the alteration that occurs in the adjacent tissues as a result of the venous anastomosis of the sinus, and the necessity of treating the phlebitis not only by drainage but also by placing the inflamed venous radicals at rest by ligation of the common or internal carotid artery. Case 22, in which this treatment was administered with recovery, is not, to the reviewer, convincingly one of thrombophlebitis of the cavernous sinus.

The various routes of invasion into the sinus are fully discussed. There are chapters on diagnosis, differential diagnosis, embryology, surgical anatomy and pathology, prognosis, operative treatment, and treatment by serotherapy and vaccinotherapy. There is also a short chapter on immunization of donors by Arthur J. Eagleton.

In addition to a special bibliography in connection with each chapter, a general bibliography is appended. In the bibliography, there are mistakes in the names of the authors given in at least two instances; Gallenaerts for

Gallemaerts and Landsberg for Landesberg. The paper referred to on page 109 as by Zentmayer and Weisenburg was by Zentmayer. The case was not one of cavernous thrombosis. The paper by Zentmayer and Weisenburg on cavernous thrombosis is not mentioned. Probably the two were confused.

UEBER DAS MORPHOLOGISCHE WESEN UND DIE HISTOPATHOLOGIE DER HEREDITAER-SYSTEMATISCHEN NERVENKRANKHEITEN. By KARL SCHAFFER, o. ö. Professor der Psychiatrie und Neurologie an der Universität Budapest. Pp. 250, with 135 illustrations. Price, 24 marks. Berlin: Julius Springer, 1926.

This little monograph is a collection of the work that Schaffer has done on hereditary diseases during the last twenty years. His ideas concerning involvement of the central nervous system according to three groups are well known: (1) those that show germ layer selectivity; (2) those that show system selectivity, and (3) those that show segment selectivity. All the diseases that are considered are fitted into one or another of these groups. He attempts to show that "the systematic hereditary nervous diseases have not only a clinico-biologic relationship but also a similarity histopathologically."

The book is divided into three parts. The first is a general consideration of the systematic heredodegenerations, subdivided into acute and chronic degenerative changes of both neuronal and glial elements. In this are taken up the Nissl pictures, the fibril stains and the lipoid elements with an excellent discussion of the micromorphology of the degenerative products. The second portion consists of the special microscopic changes of hereditary diseases: (1) spastic or pyramidal degenerations; (2) dyskinetic or extrapyramidal heredodegenerations, including hereditary chorea and torsion dystonia; (3) congenital familial muscle atrophy of spinal origin, the so-called amyotrophic heredodegenerations; (4) cerebellar heredodegenerations including true cerebellar heredo-ataxias and involvement of the cerebellum in conditions like Friedreich's ataxia, myoclonus, familial idiocy, juvenile general paralysis; (5) a discussion of the entire subject of idiocy, especially the form on which Schaffer has done pioneer work, the so-called Tay-Sachs-Schaffer form. Juvenile and adult forms are likewise considered. The entire work is excellently summarized in the final chapters, and the bibliography covers more than seven pages. The illustrations are excellent. The book is worthy of careful study, as particular attention is given to the pathology by one who is recognized as a leading neuropathologist.

PRÉCIS DE SÉMÉIOLOGIE NEURO-PSYCHIATRIQUE À L'USAGE DES PRACTICIENS. By A. ROUQUIER. Pp. 272. Price, 32 francs. Paris: Gaston Doin & Cie, 1927.

This book attempts to give an outline of the symptomatology of nervous and mental disease in 265 pages. The neurologic part comprises 203 pages, and the psychiatric part, sixty-two pages. The treatment is sketchy. However, as the book is intended for the student and general practitioner, it is adequate for its purpose, for the material is well presented. It has few illustrations, always a serious fault in a book of this kind.

Perhaps the most interesting thing about the work is its arrangement. It begins with a discussion of the motor symptoms, in which there is the usual exposition of the results of lesions of the pyramidal tracts. This is followed by a discussion of lesions of the spinal cord and the cerebellum. The extrapyramidal syndromes comprise about thirty-four pages. The subdivisions are interesting. There is first an explanation of the anatomy and physiology, and then follow discussions of parkinsonism, Wilson's disease, Thomsen's disease, which is

usually classified amongst the myotonias, torticollis, acute chorea, Sydenham's chorea, the myoclonic and choreic type of epidemic encephalitis, chronic chorea, under which is discussed Huntington's disease, the type of chronic chorea described by Brissaud, which differs very little from Huntington's type, the myoclonic epilepsy of Unverricht, maladie des tics of Gilles de la Tourette, athetosis and, lastly, pseudobulbar palsy. It can be readily seen from this that every kind of tremor and movement is classified under the broad definition of extrapyramidal disease. While there may be some grounds for this assumption, nevertheless, to assume arbitrarily that these diseases have an extrapyramidal pathologic change is rather an advanced step, particularly from the standpoint of the student.

DIE PERIPHERISCHEN LÄHMUNGEN, DIAGNOSTIK, UNTERSUCHUNGSTECHNIK, PROGNOSTIK UND THERAPIE. PROF. DR. TOBY COHN. Pp. 320. Price, M. 18; bound, M. 21. Berlin: Urban and Schwarzenburg, 1927.

This book on the peripheral nerve paralyses grew out of an article that was published in Kraus-Brugsch's book "Die Lähmungen der peripherischen Nerven einschliesslich der Untersuchungstechnik." It has been somewhat modified and rearranged. As would be expected, the additional knowledge gained through the war has been incorporated. The arrangement of the subject matter is the usual one adopted in most textbooks. It begins with a general introduction, then gives diagnostic methods with various tables showing the differential diagnoses between peripheral nerve and allied diseases. It is interesting to note that the author discusses psychic peripheral paralyses and terms them psychogenic akinesias. The technic and methods of examination are well done and well illustrated. Then follows a discussion of the toxic neuritides, pathologic anatomy, prognosis and therapy. Particular attention is paid to the electrical examination methods and physiotherapy. In the second large division of the book there is a distinction betwen the cranial and spinal nerves. Among the cranial nerves only the trigeminus, facial, glossopharyngeal and vagus, accessory and hypoglossus are discussed, the ocular not being mentioned. The treatment of the spinal peripheral nerves is along the usual lines. Here, also, the illustrations are excellent.

TECHNIQUE DE LA RÉACTION DU BENJOIN COLLOIDAL. By GEORGES GUILLAIN, GUY LAROCHE and P. LÉCHELLE. Pp. 36. Price, 11 francs. Paris: Masson et Cie, 1926.

This small brochure contains a detailed description of the technic of the colloidal benzoin reaction which was originally described by the authors in 1920. The present work does not contain any discussion of the theory or literature of this now widely used test, such as was presented in 1922, and is printed in response to requests for information concerning technic. The authors stress the importance of securing pure reagents, clean glassware and freshly redistilled water. The purity of the gum is important; ordinary commercial powdered benzoin is unreliable and should not be used; the form recommended is the amygdaloid benzoin from Sumatra. The reaction, in the hands of the authors, correlates well with the Wassermann reaction and has advantages as a check on the effects of therapy; the test is simple to perform and does not require much time. This little book will be found valuable in every clinical laboratory.

DIAGNOSTISCHE UND THERAPEUTISCHE IRRTÜMER UND DEREN VERHÜTUNG. INNERE MEDIZIN. Edited by PROF. DR. J. SCHWALBE. Vol. II. KRANKHEITEN DES RÜCKENMARKS UND DER PERIPHERISCHEN NERVEN. By PROF. DR. R. CASSIRER. Reedited by PROF. DR. R. HENNEBERG. Pp. 142. Price, M. 7.80 Leipzig: Georg Thieme, 1926.

This small book of 142 pages contains a discussion of diseases of the spinal cord and of the peripheral nerves. As a result, the subjects are cursorily treated; tabes and multiple sclerosis in twelve pages each and tumors of the spinal cord in seventeen. Nevertheless, the subjects are well covered, and while the book is ostensibly written for the general practitioner, the neurologic student will find many things of value.

Because of Prof. R. Cassirer's death, the present volume has been reedited by Prof. R. Henneberg.